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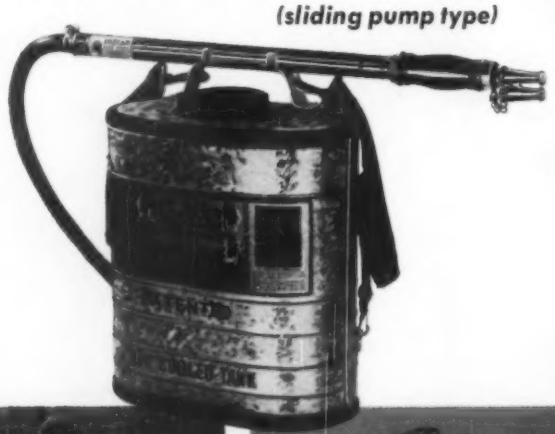

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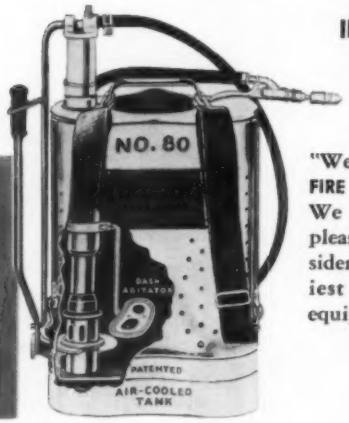

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CONTENTS

COVER: Ocean Park Recreational Area, Osceola National Forest, Florida.
(Photo courtesy U. S. Forest Service, by Dan Todd.)

Impressions of Industrial Forestry in Southeastern United States ..... Walter H. Meyer 179

Statistics from Schools of Forestry for 1959: Degrees Granted and Enrollments ..... Gordon D. Marckworth 188

Sprouting of Loblolly Pine ..... S. Little and H. A. Somes 195

Site Index for Planted Red Pine by the 5-Year Growth Intercept Method ..... M. W. Day, C. F. Bey, and V. J. Rudolph 198

Appraising White-Pine Weevil Control Opportunities ..... Robert J. Marty and Glenn R. Allison 203

Mortality in a Longleaf-Slash Pine Stand Following a Winter Wildfire ..... Theodore G. Storey and Edward P. Merkel 206

The Australian Mistletoe ..... D. Hartigan 211

Notes and Observations 219

Fifth World Forestry Congress—Provisional Program; Soil Moisture Distribution Between Trees in a Thinned Loblolly Pine Plantation; A Prostrate Mutant of Black Locust.

Points of View 223

Replies to Comments on Forestry Education and Licensing; Comments on "Are Subsidies Necessary to Stimulate Private Forestry?"; Proposal for Stockpiling Wood Samples for Teaching Purposes.

Book Reviews 226

The Colonel William B. Greeley Lectures in Industrial Forestry: No. 3: The Development of Industrial Forestry in the Northeast; Accreditation: The Struggle over Standards in Higher Education; John Muir, Naturalist: A Concise Biography of the Great Naturalist; Hydrology; Aboriginal Man and White Man as Historical Causes of Fire in the Boreal Forest, with Particular Reference to Alaska.

Current Literature 230

Society Affairs 232

Forestry News 251

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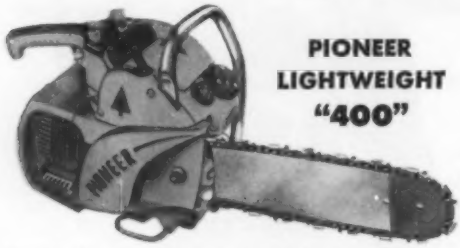

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Journal of Forestry

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Impressions of Industrial Forestry in Southeastern United States

Walter H. Meyer

IT IS generally acknowledged that that the adoption of sound forestry practices by private owners, particularly the large industrial owner, has made tremendous strides in the last decade or two. Yet, the literature is singularly devoid of explicit accounts of the full extent and nature of the progress. A few accounts of general progress may be found in terms of total number of foresters employed, of total acreages under various broad categories of practice intensity, of the improvement in forest fire coverage, and so forth, but if one is interested in detailed development he will find very little of value. Occasional descriptions of individual operations appear here and there, usually fragmentary or confined to a limited field and in insufficient number to warrant broad interpretation. Even when one has been associated with the development of a few specific industrial forestry programs, as has been the writer's fortune for the last 15 to 20 years, he will not be able to generalize upon his limited experience and construct a picture of the status of forestry practice in the remainder of his region and particularly of other regions. As a vivid example is a comment made recently by a forester of long experience who had made his first trip to the West Coast. He exclaimed in astonishment and concern that everything he thought he knew about West Coast forest management was wrong and, furthermore, that no one had ever told him how wrong he was. Foresters in private employ are not prolific writers and many a light is hidden under the proverbial bushel. If a forester wishes to find how his neighbors fare and if he wishes to benefit from the experiences of others, he must rely upon personal visitations rather than a study of literature, which incidentally can be quite misleading at times. Fortunately for the profession, such visitation and interchange of experiences is common and has helped a great deal in advancing the practice of forestry in the United States.

Only 25 years ago, it was estimated[1] that in all of the United States only 146 technically trained foresters, employed by 79 companies, were engaged in timber management. In a contemporary estimate by Graves and Guise,[2] the grand total of forest school graduates privately employed in all lines of activity was about 800. This undoubtedly included not only timber growing, but also logging, procurement, manufacturing, sales, general management, and all other activities in which a forester could engage. By 1951, according to Shirley,[3] the total number of technically trained foresters in private employ had increased to about 4,400. Now in 1958, the unofficial estimate places the number at well over 7,000, thus at least a ninefold increase in 25 years' time. This is an example that great progress has been made, but revealing little about the nature of the progress, particularly in a specific region.

In order to get a fuller appreciation of the development, at least for a limited portion of the United States, the writer spent the greater part of two months in the autumn of 1958 in traveling through the South, particularly the Southeast, interviewing the heads of various industrial woodlands and forestry organizations or their designated representatives. The objective of each interview was to gather information on the type of the parent company, the development of the organizational structure of the forestry department, its functions, the methods by which these functions were carried out, the general status of the forest properties, the character of the current major problems, and other matters that

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[1] 73rd Congress, First Session. Document No. 12. A national plan for American forestry. 1933.

[2] Graves, H. S., and C. H. Guise. Forest education. Yale Univ. Press. 1932.

[3] Shirley, H. L. Forestry and its career opportunities. McGraw-Hill. 1952.

could lead to a good understanding. During the course of about 12,000 miles of travel, two dozen major and several short interviews were held, an interview lasting ordinarily a full day, in discussion and field trips with one or more members of the forestry staff. In effect the interviews constituted a series of abbreviated case studies. The experiences gained were so interesting and revealing that it was felt that a summarization of the findings would be of general interest to other foresters, particularly those who were not familiar with the Southeast. It is possible that much of the following will not be new to the experienced forester of the Southeast, although even he may be unaware of the variation and ramification of the many ideas and actions that contribute to good forestry practice in the area.

The Sample

No claim is made that the interviews cover an unbiased sample of southern operations and no attempt will be made to extrapolate the findings to regional totals. The selections were made first of all to fit into an efficient route of travel; second to get a cross-section of as many kinds of operations and situations as possible in the allotted time; and third to visit only those operations that were known to have foresters and a forestry program. The discussion that follows will be based on 21 organizations visited in the Southeast, specifically the seven states of Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, and Tennessee, plus two operations in Texas that fit into the same general pattern. There will be no attempt to describe or even name any single organization but rather to discuss the general pattern or lack of pattern that appears to prevail in many phases of the forestry activity. Summarizations of this kind are rather difficult to make, owing to the complexity of the situation, but they are drawn with the hope of establishing a general picture.

Four general classes of organization can be recognized: (1) lumber companies, of which there were five in number; (2) pulp and paper companies, 12 in number; (3) integrated lumber-pulp and paper company, 1 in number; and (4) "land management" companies, at least 3 in number. The last group was associated with pulp and paper units but had a high degree of freedom of action in the disposal of the raw wood material.

Of the various organizations, seven can be classified as family companies or organizations, and five as wholly owned subsidiaries of larger corporations. Six were branches of corporations with interests in other parts of the South, two were with interests in other regions, while three are branches of organizations of international status.

Only rarely during the interviews was information withheld or given with the request that it be kept confidential. The nature of this report will not violate these few confidences. This point is purposely mentioned to illustrate how unusually free the interchange of ideas and experiences is among foresters at the present time.

Although as mentioned above, the sample is by no means unbiased, its sufficiency is another matter. Fifteen of the 49 pulp and paper companies in the seven named southeastern states were visited. These 15 had together 39 percent of the listed daily pulp and paper capacity and consumed over seven and a half million cords a year, or over 50 percent of the listed consumption in the seven states.[4] The operations visited had under their direct control a total of close to eight million acres in fee title and at least one and a half million more under lease or management agreement. This total does not include acreages on which simply cutting rights were held, where the operation did not assume the management function or responsibility; nor does it include acreages held in other regions or countries by the companies visited. The sawmill units by themselves had a total annual production of 500 million board feet and owned about 1¼ million acres. The smallest ownership was approximately 125,000 acres and the largest somewhat over one million acres. Thus the representation is rather generous, even though its sampling quality leaves something to be desired.

Number of Foresters Employed

A first though superficial measure of the acceptance of forestry may be based on the number of foresters employed, which in the case of the operations visited amounted to over 500 technically trained men. Distributed over the total of nine and one-half million acres under control, this apparently gives an average of one trained forester to nineteen thousand acres. The densest population for any one operation, in this case a pulp and paper company, was one forester to six thousand acres and the thinnest was no technically trained forester but on excellent woods-trained forester to 200 thousand acres in the case of a lumber company. Such numbers, however, may be misleading since the forester's functions commonly cover many additional activities not directly in the line of land management, such as staff services of many kinds, so-called conservation forestry or work with small private land owners, and particularly raw material procurement on the outside. A common situation is to place a technical forester, often with a trained assistant, in full charge of the active management of a unit of from 30 to 50 thousand acres in size.

A noticeable contrast existed between the lumber companies on one hand and the pulp and paper companies and land management companies on the other. Four of the five lumber companies had from one to four foresters and the fifth 25, for areas varying from 150 thousand acres to about 700,000 acres. The pulp and paper companies employed from 20 to 50 foresters for areas running from 200,000 at 1,000,000 acres. The reasons for the difference are several

[4] Southeastern Forest Expt. Sta. and Southern Forest Expt. Sta. in cooperation with the Southern Pulpwood Conservation Association. 1957 Pulpwood production in the South. 1958.

and, in the writer's opinion, not necessarily associated with the intensity of forestry practice and the success of results, but with the functions that the forestry units supervise as will be described later.

Place of Forestry in the Parent Organization

The coming of age of forestry and its acceptance in an organization can be gauged in part at least on the place that the activity occupies in the parent organization plan. In every instance but one, forestry usually combined with raw material procurement constituted a department, division, or staff position of equal ranking and autonomous with other major organization units such as manufacturing or sales. The forestry head reported directly to the general manager. In the one exception, which involved the one observed integrated sawmill-paper mill unit, the woods and forestry activities were combined with sawmilling and the two together had equal ranking to the pulp and paper mill.

The names of the units and the frequency of unit types are revealing of their scope of activity. These were:

- 11 Woods or Woodland Departments or Divisions
- 4 Forestry Departments or Divisions
- 2 Timber Departments or Divisions
- 4 Staff foresters directly under the general manager, all of these with lumber companies.

In most of these departments or divisions, forestry shares the spotlight with procurement. Of the 23 units listed above, 18 were headed by trained foresters. In four of the remaining five, the forester was second in command. For the sake of convenience and brevity in the remainder of this paper, the forestry organizations associated with lumber companies shall be referred to as sawtimber units; those with pulp and paper companies as pulpwood units; those with land management companies as land units; and those with the combined sawmill and pulp-paper company as integrated units.

Organization Chart

There are as many forms of organizations as there are companies. Incidentally, this is one item on which a request or two was made that the information be held confidential, possibly for the reason that the particular form of organization in question was the result of long experience and development and contributed more to success than any other factor.

Four of the five sawtimber units had all the forestry work and sometimes the logging under the control of one or a few staff members, not organized as a department but reporting directly to the general manager. The fifth unit had an organized department with a large staff, resembling the situation that will be described for the pulpwood units. In three of the five sawmill companies, the forester's function covered logging in addition to all land and forestry activities. In all five instances, the logging was done by company crew, a distinct contrast to the pulpwood units and land units where no logging was done by the department, except here and there for experimental purposes.

The pulpwood, land, and integrated units, plus one sawtimber unit had sizeable organized staff and line positions. The pulpwood units often had the function of procurement of large supplies of pulpwood on the outside, since the company lands furnish only a small part of the requirement. Only in two cases was the procurement function split off from the woods and forestry unit. In eight instances, the procurement function was in the woods and forestry department but as a unit separate and equal to forest management. In three cases, procurement and forestry were combined in the same unit. At times the procurement staff was composed entirely of foresters, at other times non-technically trained wood buyers took over.

The larger units render two classes of services, namely the staff services out of the headquarters office, and the line services of the field. There was little resemblance in the formation of staff and line services between any two units. Every company presented an individual case and undoubtedly had good reasons for having its particular form. The local situation, individual preferences and experiences, functions exercised and availability of funds all play a part in shaping the form. Staff services in particular ranged from the very complete furnishing of all possible technical aid and overhead control to the line force on to exceedingly meager assistance. Line services, in particular the delegation of authority down to the ultimate field functionary, showed a somewhat more consistent pattern. It would be indeed difficult to draw up a model organization chart on the basis of those that had been observed.

Functions of the Forestry Units

As a general rule, the functions of the woodlands or forestry units cover all activities outside the millyard, with minor exceptions. For example, the procurement activity is sometimes in a separate department, as mentioned above. In the usual case, the settling of land tax affairs is handled elsewhere, although the woods departments prepare the records. It is within the functional phase that one notes the greatest contrast between the pulpwood units and the sawtimber units, a contrast which explains in large measure the difference in staff size as noted before. The majority of the pulp and paper companies have entered the scene at a relatively late date and had to acquire lands wherever they could, whether satisfactorily stocked or not. This even applies to an organization that had existed in the Southeast for the last 50 years or more, in that the bulk of the original lands were lost to the company by condemnation for public use and a new acquisition program had to be adopted at about the same time that other companies started to get into the South. Much of the land thus acquired by the pulp

and paper companies was originally poor in stocking; much of it presented serious handicaps to the full production of timber; and much of it lay in small parcels scattered over wide areas. The visited lumber componies on the other hand had been in operation for a long time, and owing to their conservative policies had maintained a good forest stand and for this reason were able to outlive many of their competitors who were not so forestry-minded. A number of old-line companies with excellent forest resources have been acquired as choice plums by the pulp and paper industry, and are tracts which represent a contrast to the usual situation. They constitute, however, a special problem to the pulp-paper properties in that high prices had to be paid for the sawlog volumes, which must then be disposed of on the log market since the investment does not justify its present or future use as pulpwood. One of the sawtimber units included in the survey is going through this stage. It was on old-line lumber company which recently sold out to five new owners, three of them actively engaged in pulp and paper manufacture. The land has already been divided equally among the five new owners. The sawtimber is being liquidated in its entirety over a six to ten year period by a newly organized sawmill company, with the proceeds distributed equally among the new owners. In the case of some of the new owners at least, the area is being converted as rapidly as possible to a new short rotation forest by complete liquidation of all values, followed by extensive site preparation and planting.

Although the general functions of the two groups, that is the sawtimber and the pulpwood units, cover the same fields of land management, protection, forest production and procurement, those of the second group tend to be much more involved and intensive. The sawtimber units usually deal with fairly compact ownerships; their lands are in relatively good shape for sawtimber production, though admittedly in not so good shape for pulpwood production; there is little need for intensive site preparation on a large scale; the planting activity is modest, usually being done on open land only; regeneration is usually obtained by natural means; the procurement job is fairly simple, since they are self-sufficient to a large extent and need not go much into the general stumpage market; logging is under good control, being done by company crews; and so forth.

With the pulpwood units, in contrast, ownerships are commonly widely scattered in small tracts; the lands are often in poor shape for full pulpwood production, having been purchased at a relatively recent date; there is usually a strenuous effort to set up the areas for full production by intensive site preparation and planting over large areas; regeneration, at least for the first time around, is largely obtained by artificial means, the exception being in the loblolly pine types, where more dependence is placed on natural regeneration; the procurement job is big since 65 to 95 percent of the raw material must be purchased in an open market of a highly competitive nature; harvesting is done by dealer or contractor negotiations, and so on. Thus it is easily seen that the demand for technical forestry and procurement skills is far greater on a pulpwood unit than in a sawtimber unit and is the main cause for the differences in staff size. The sawtimber unit with its smaller staff can actually do as good a job with the resource it has to handle from a sawtimber standpoint as the pulpwood unit with its larger staff and its forest situation from the pulpwood viewpoint. Public credit usually goes to the organization with the larger staff, not necessarily with the larger workload per man.

As can readily be inferred from the above, one of the major activities of forest management in the Southeast is to build up the growing stock for future full utilization. Two major phases of this function can be recognized, the first being to improve the existing growing stock by the use of such timber stand improvement actions as girdling, chemical treatment and spraying, prescribed burning, thinning, and so forth; the second being to apply wholesale conversion of existing inferior or cull stands by complete removal of current values and then going into intensive site preparation and planting or seeding. At times a combination of the two is contemplated in that the present stand is good enough, though not completely satisfactory, for development to harvesting age, following which the area will be completely converted by site preparation and planting to a new, full stand. Not included in the above three actions is that of developing new forest areas from swamp lands by ditching and draining, an activity that was observed on a large scale on one operation and on a minor scale on one or two others.

These various operations are being carried out on a wide scale and are doing a great deal to change the forest landscape of the Southeast. Of all the operations visited only two did little or nothing except for planting, being located in areas where all species and grades of wood had or promised to have a salable outlet. Since many operations used a variety of methods, the tallies below are not mutually exclusive. At least 12 units used girdling and poisoning and three more girdling alone to improve existing growing stocks. This activity was more common in the loblolly shortleaf pine types than in the longleaf and slash pine areas. Aerial spraying to remove a hardwood overburden or to control a heavy brush cover on areas to be regenerated is being tested out on a wide scale here and there and, although still more or less in an experimental stage, promises to be much more widely used in the future. Spraying from the ground was used only in one case.

Only one or two units said they would have nothing to do with the use of fire in their management programs. The majority used fire at least as a brush disposal method after initial site preparation on conversion jobs; three operations

used prescribed fire in its orthodox sense to produce silvicultural advantages. Two of these were sawtimber units located in the longleaf type, both of them enjoying excellent results.

Site preparation takes on many forms, each organization having developed a technique to fit its particular situation in regard to topography, soil, overburden, rough, and brush. Many units use several techniques, each for its special situation. For easy conditions such as sod, small brush or palmetto on sandy soil, simple harrowing may suffice, particularly if two treatments are used, the second following the first after a three to four month delay and made at right angles to the first. For somewhat the same situation, the Marden chopper was found useful by four operations. With heavier brush conditions, as found particularly on scrub oak ridges, the sequence of complete bulldozing of all brush and trees after the removal of any crop value, gathering of the brush into windrows by root rakes, burning the windrows, and finally harrowing was found to be the best practice on at least five operations. Straight bulldozing without windrowing, burning and harrowing sometimes sufficed. Two operations did very effective clearing of scrub hardwoods on sandy soils by dragging a span of anchor chain between two Caterpillar tractors. The use of a DSW brush cutter followed by raking into windrows and burning, or of a K-G blade had its proponents.

No precise statistics are available on the sum total of area treated in one way or another, but it must amount to over two hundred thousand acres annually on the operations visited, with a maximum on any one operation of about 20,000 acres a year. In all cases of site preparation and conversion, the lands were planted of course, with direct seeding coming into the picture in the last year or two. Throughout the Coastal Plain the favored species is slash pine; in the Piedmont areas it is loblolly pine. A visiting forester may well wonder whether these forceful measures of conversion, site preparation, planting of a species in areas where it previously had not existed, all on light soil and with short rotation turnovers will be successful over the long run. The initial results are excellent and are visual proof of their effectiveness at least as the primary instrument of bringing an area to full production in a short time.

Of the 23 operations visited, only two appeared to do little or no planting, and one more practically, at the end of its ambitious planting program. The remainder were actively planting anywhere from one thousand to 27 thousand acres each annually. The total planting per year for all operations ran slightly less than 200,000 acres. Incidentally, the 1957-1958 *Conservation Yearbook* shows that in 1955 all private industrial operations in the United States planted only 371 thousand acres. The same *Yearbook* states that in the seven southeastern states visited, there were only thirteen nurseries run by private industry in 1957, with a production of possibly 79 million seedlings a year, and four new industry nurseries coming into production in 1958. In contrast, of the 23 operations visited in 1958, eight companies alone ran ten nurseries with a total capacity of close to 140 million seedlings annually, to increase shortly to 175 million.

Procurement Procedure

As mentioned previously, the pulp and paper companies depend heavily on outside procurement of pulpwood to supply daily requirements. Even in the future when the company forest attains acceptable stocking, the expectation is to buy from one quarter to one half of the requirement and not to rely one hundred percent on its own supply except in times of unusual stress. The opinion was held universally that for the next five to ten years the competition for pulpwood in the open market would be severe, but after that the pressure will ease and there will be a sufficiency of supply for all, even assuming industry expansion.

None of the pulpwood units did its own logging even on its own land, but worked through agents and concentration yards of various kinds. The most common arrangement, used by three-quarters of the companies, was to negotiate with dealers who in turn found the wood and arranged for its cutting and delivery to the mill. In the case of company-owned stumpage, a common procedure was to "sell" the wood to the dealer, who would arrange for cutting and shipment and get the regular delivered price for wood less a stumpage charge. Two organizations were emphatic in their position that they had rid themselves of the dealer system and worked directly with the producer or contractor. The majority of the units ran concentration yards on their own or were supplied in part by dealer-run concentration yards. At times, the companies helped the dealers to set up such yards.

Multiple Product Policy

Though up to this point the discussion has been in terms of sawtimber units and pulpwood units, thus risking the inference that one-product organizations are being dealt with, the actual case is quite different. The sawtimber units sell poles, unneeded sawlog stumpage, veneer logs, and pulpwood. The majority manufacture and sell pulpwood chips from their waste. The pulpwood units sell poles, sawlog stumpage, and other products that give a higher return than the pulpwood prices for the equivalent volume. In the usual case, all trees of sawlog quality, from 11 to 14 inches d.b.h., depending upon location, are sold to sawmills, particularly to those that have chip installations and can return the waste wood to the pulpmill in the form of chips. The arguments given for the sale of sawtimber trees are many and varied but center on the following points:

1. A land management unit should dispose of the raw material in the market that offers the best price, whether poles, sawlogs, veneer logs, pulpwood, and so forth, subject at times, however, to the demands of the associated manu-

facturing unit if outside procurement becomes critical.

2. Pole and sawlog values for raw material are usually superior to values for pulpwood. Some foresters consider this point debatable, since the conversion factors between pulpwood volume and board footage are often unreliable and for certain size classes and values the differential in favor of sawlogs may not be significant.

3. The ready cash income obtained from the sale of products on the outside is often of help establishing and expediting the forest improvement program, where otherwise cash might be tight.

4. In acquiring new lands high prices must be paid for all sawlog stumpage and the pulp-paper companies can ill afford to carry this investment or suffer a loss by the conversion of high priced stumpage to pulpwood.

5. The sale of products on the outside is one of the best means of establishing good public relations, since there is a rather common though unwarranted dread that the big companies are out to swallow the entire economy. It is up to these big units to live with and help maintain other forest industries in the community.

6. A reliable, steady sale encourages the establishment of efficient permanent sawmills with chipping installations, thus hastening the departure of the temporary, inefficient peckerwood mill from the woods.

7. Even though the planned pulpwood rotations are short and intensive, trees of large size and high value will be produced.

Scale Units

Pulpwood shipped by rail is practically always measured on the volume basis, usually by the standard cord, but sometimes by the unit of 168 cubic feet of stacked wood, since the freight rates, such as under the "Modified Roanoke Rapids Scale" are more favorable to volume measurements than they are to weight measurement. Wood trucked into the mill yards is, however, almost always measured by cords on the weight basis. Species mixtures in the truck load can be handled by assigning different weights per cord.

The sale of stumpage by the Doyle rule is going out of the picture, since it is rarely used in sales by the pulpwood units, though more commonly with the sawtimber units. The use of the Scribner Decimal C rule, which incidentally is the legal rule for Georgia, is common; that of International rule for ¼-inch kerf is occasional; and actual sawmill tally is rare since it is disadvantageous to the stumpage seller by not encouraging maximum lumber yield per log.

Species Preference

Though pine is the favored species for kraft pulp and furnishes the bulk of the input, hardwood is steadily coming more and more in demand, particularly for bleached pulp and for fine papers and tissues. Of the total requirement of close to seven and one-half million cords for the operations visited, approximately 16 percent was hardwood, usually without regard to species. Almost every mill used hardwood to some extent. The use of hardwood promises to increase in the future; in fact, one forester expressed concern for an adequate supply of hardwood in the future, in view of the intensive eradication program and emphasis on pure pine stands.

Forest Inventory

The situation in regard to forest inventory, as represented by the operations visited, is in active stage of revision. A pattern is emerging which involves the use of a light sampling by permanent plots for general control and planning purposes, supplemented by a reconnaissance of one kind or another for the portion of the forest area proposed for operation for the coming year. This pattern is by no means well developed as yet. Existing inventory methods are difficult to summarize as there are so many variations and since in more than a few cases a change from one kind to another is in progress.

In the not too distant past, the inventory systems were usually based on a fairly intensive cruise, such as 5 or 10 percent coverage, and stressed the determination of volume as associated with place, with little emphasis on the description of forest conditions and special silvicultural or harvesting needs. The system was time-consuming and costly; yet in several instances a definite plan of repeating the inventory at periodic intervals was adopted. The hope was obviously entertained that such an inventory would not only supply the needs for developing the long-term management program, but also for framing the short-term (annual) operational program. Within the last ten years or so, the realization arose that a light sample inventory was quite satisfactory for the purposes of long-term planning and could be done cheaply enough so that its repetition at periodic intervals was feasible and attractive. Not too well realized was the fact that such an inventory, excellent as it may be for this specific purpose, did not furnish the requisite information for the annual operation and would have to be supplemented by some form of operational inventory. Only rarely was the principle of light sampling applied by the use of temporary sample plots. A clear departure was usually made completely over to the establishment of permanent sample plots, a sys-

TABLE 1.—TYPES OF INVENTORY

1. No modern cruise; reliance on acquisition cruise	2 units
2. Occasional, non-periodic cruise with temporary sample plots	4 units
3. Periodic cruises with temporary sample plots	
a. 5 to 10 percent sample	7 units
b. 1 and 2½ percent sample	3 units
(Of these, supplemented or being replaced by light sampling of permanent plots)	(4 units)
4. Permanent sample plots (including the 4 above)	
a. for growth only	2 units
b. for "continuous inventory"	7 units
5. Use of stand condition maps or reconnaissance cruises to supplement management cruise	10 units at least

tem now commonly referred to as continuous forest inventory. A condensed listing of inventory forms may possibly be the clearest way of describing the current situation.

The total tally (Table 1) adds up to considerably more than the number of operations visited, since in many cases more than one method was in use. Category 3a of the above listing includes two cases where complete coverage of the ownership was made over five to eight years time by covering a proportionate area per year, rather than attempting to get the coverage in a short time at periodic intervals. This proportionate coverage per year was also commonly typical of the units that used permanent sample plots.

That permanent plots were attracting increasing attention is evidenced by the fact that five of the nine units in category 4 were still in the process of installing them; an additional three units were thinking of using such plots. Of those which had a fully installed permanent plot system, one confessed that it could find no use for the information. In every instance, the trees on the permanent plots were individually marked or tagged, a procedure which in the writer's opinion will call attention to the plot and consequently tend to lead to special treatment, as was freely admitted from time to time. To be fully effective, the plots must fare exactly as the surrounding area; if they do not, they become less and less representative of the situations they are supposed to represent.

Rotation

The rotation length for the pulpwood units is set usually at 30 years, with an occasional increase to 35 or even 40 years or a rare anticipation that it may be eventually reduced to 25 years. With the sawtimber units, the rotation concept is less well developed since they are still operating on a single tree or small stand selection basis and need not be involved with the determination and acceptance of a fixed rotation for the time being at least. Rotations ranging from 50 to 80 years were mentioned as being good possibilities. In one instance a compromise was sought in that the main stand was to be grown on a pulpwood rotation of 30 years, but a generous supply of seed trees would be held to develop as sawtimber standards on a 60-year basis.

Subdivisions for Management

Although there is no constant pattern of the divisioning of a forest ownership into units for administration and control, as regards size, purpose or nomenclature, there exists a general theme with as many variations played on it as there are companies. This theme involves the successive breakdown from Nation to Region to Area to Forest to Management Unit to Compartment or Block and finally to Stand or Legal Subdivision. The working circle concept, according to the standard definition of being a unit for which a separate plan of management for sustained yield is drawn, appears at least at three levels, namely the Area and the Forest and the Management Unit depending upon circumstances.

Of the companies visited, three belonged to parent organizations that had international interests, two more with nationwide interests, and six more with interests in various parts of the South. The following discussion will start with the regional level and proceed to describe the successive sub-levels. The regional level involves ownerships plus areas under control of 500 thousand acres or more. They are first split for purposes of general administrative control into two or three large units, variously called areas, districts, divisions, or regions. At this second level they are joined by ownerships of 300 to 500 thousand acres, about 12 in number, making a grand total of 19 different organizations. The second level group is then divided into units ranging from about 25 to 100 thousand acres to constitute the third level group, organized for the purpose of delegating administrative control still further and, more significantly, for purposes of forest management, control and production. The third level division is called a "district" in about half the cases, with "area" and "forest" common. The third level group is joined by ownerships of 100 to 200 thousand acres, usually sawtimber units.

From the third level on the pattern loses consistency, since in some cases the next step may be to the fourth level, the restricted "working circle," in others the fifth level, "compartment," and in still others the sixth level, "stand." Since some of the areas in the third level amount to 70 thousand acres or more in size, the need has been felt in six instances to subdivide it into units of 25 to 30 thousand acres that can be effectively handled as a working circle by a single technically trained forester. These areas called "management units" or "working circles" are commonly divided into a number of areas equal to the rotation age and equivalent to annual cutting compartments.

Six others from the third level subdivide directly into fifth level blocks or compartments, ranging from 100 to 2,500 acres in size, which in a few cases may be recombined into annual cutting compartments. Thus the fifth level division is rather complex but it commonly serves the purposes of location of the operation, attaining regulated flow of raw material, and in many cases being the unit for collection of records. Included in this level are also the sawtimber units that operate on a selection cutting basis and cover the entire tract in a cycle of years with annual cutting compartment boundaries quite flexible in space and time.

The remaining units in the third level group proceed directly to the sixth level subdivision by stands or in a few cases to the legal subdivision, lot, or original purchase area. The bulk of the sixth level subdivisions arise, however, from the fourth and fifth levels.

An increasingly popular method of subdivision involves the establishment of working circles of approximately 30 thousand acres, di-

vided into 30 equal annual cutting compartments. At the time of original establishment, the 30 compartments are assigned priority harvest cutting dates, depending upon their need for cutting, one for each year of the 30-year rotation. The priority listing may be revised in later years if considered desirable. The compartment boundary is permanent in nature; the stand subdivision which usually accompanies the original layout has purely temporary boundaries. The major objective is to convert each compartment in its scheduled cutting year to a fully stocked even-aged stand and to treat each fifth year compartment for thinning or silvicultural treatment according to its needs. At the end of the first rotation a fully stocked normal forest would thus be achieved. In the usual instance, the stands in a compartment are initially poorly and irregularly stocked; a callous approach would be to sacrifice all existing potential value development, clean off the stand and start off with a full stand immediately at the most reasonable cost. Few foresters, however, seem prepared to go wholeheartedly in this direction. In a number of cases, for example, the compartments are classified into two general groups, namely "volume-control blocks," and "area-control blocks." In volume control blocks, there is sufficient volume and value existing on portions of the tract at least to warrant growing and holding to the end of the rotation. In area-control the stands are so poor in stocking that little sacrifice will be involved if all existing values are removed and the land completely cleared and regenerated, even to the extent of using the full sequence of site preparation and artificial regeneration methods. Some of the foresters who use volume control blocks claim that they will reach full stocking over their forest in a time substantially shorter than if they had used area control.

Objections to the area-control compartment has been voiced on a number of occasions, stressing such points as:

1. The large size of the area necessarily covers logging chances of many kinds and it may often not be possible to confine one's attention to a single block for the year;
2. The establishment of an even-aged forest of a single species, particularly by planting, may accentuate disease, insect and storm hazards;
3. Large homogenous compartments are out of the question where the ownership is badly split into numerous scattered parcels, as is so commonly the case; and
4. Strict adherence to area control may involve great sacrifice of existing and potential values the first time around.

Harvest Cutting

In general, the sawtimber units currently rely on single tree or small stand selection, with tree length logging and hauling not at all uncommon. However, a number of the sawtimber units aver that even-aged management will be their eventual goal. At the current time, as the result of good practices of the past few decades, the volume of cut taken tends to increase each year. Natural regeneration is relied upon, whether the forest is composed of loblolly, shortleaf, slash or longleaf pine, except of course in the case of conversion of low-grade, brushy areas or open lands where artificial regeneration is used. A ten-year cutting cycle is common.

The majority of the pulpwood units use clearcutting and planting, but not far behind are those that use clearcutting and seed trees. The latter are usually located in the loblolly pine type and areas with heavier soils. In the Coastal Plain particularly, slash pine is by far the most common species used in planting. Longleaf pine culture, either artificially or naturally, is usually considered to be too difficult and hazardous. As a result, slash pine is being placed on extensive areas and sites where it has never grown before. Where seed trees are used, the plan is usually to remove the seed trees after they have done their job. In a rare case or two the seed trees will be held as standards for the purpose of producing large sawlogs at the end of the second rotation.

Management Plans

Management plans as they exist in such agencies as the U. S. Forest Service were rarely encountered in the survey, although they are in the course of development here and there. Although the management policy is well established throughout, the implementation of the policy through a specific written plan of action for a period such as ten years seems to give place to short-term plans for the year immediately in prospect. The policy statement or decision sets up the general course of action and the major objectives of the proposed management program. The management plan, based on a review of the entire forest resource, defines the lines of action that will be followed over the course of a specified future period, subject to revision at the end of that time. The annual plan spells out the specific action for the coming operational year. In the Southeast, therefore, there usually appears to be a gap between the policy decision and the annual plan, a situation which will be changed as the present years of forceful conversion from one forest situation to a new condition pass by and the future growing stock can be better envisioned.

Major Problems

Queries as to the major problems confronting the forest management units brought forth some interesting information. One unit surprisingly stated that it had no major problems; that although a number of situations and conditions needed adjustment, the methods of correction were known and were practicable. Most units agreed that certain elements formerly considered to be major problems were now under control. One of these was fire. Formerly considered to be the greatest obstacle to the practice of forestry in the Southeast,

the general consensus, except for one or two striking exceptions, was that the fire situation was under control, although fire protection would always be a high priority activity. Incendiarism has been greatly reduced over much of the area. Within the last few years there has been a great improvement in protection effectiveness and protection measures are usually adequate; finally, much more land than ever before is now under organized protection. Serious conflagrations, however, are not yet a matter of past history, since several large burned areas of fairly recent date can still be seen.

A second element was the land and timber tax. For many years after the final cutting of the virgin timber, land and timber taxes have not been unreasonable. However, in the last year or two, the topic is coming to the fore again, since taxes are beginning to rise sharply here and there, particularly in Florida. A few foresters say this is the result of trying to bring taxes into line with increased costs of administration. Discrimination in assessment of large properties is common, but recourse to the state boards of equalization usually gives adequate revision.

One of the major needs is good public relations. The large ownerships are suffering not only through discriminatory assessment, usually remediable, but also through unwarranted public fear that the large owner will soon take over the entire local economy. Attempted legislation in Georgia to restrict further acquisition by anyone who already owned a specified acreage is one example. One of the best forms of promoting good relations is to help maintain local industries by providing raw materials; by reestablishing naval stores operation in suitable areas where it was formerly prominent, but had virtually disappeared from some of the new large ownerships; by making the new road networks available to the public; by cooperating in fish and game programs; and so forth.

Scrub oak, worthless hardwood areas, swamp lands and such are problems in the sense that their conversion is costly and money may currently be tight. The methods of conversion are usually well known and satisfactory. A universal concern is to get a full stocking at an acceptable cost. Limitations still exist that prevent the wholesale conversion of all classes of land.

Competition for pulpwood is a definite problem since the lands owned or under control by the pulpwood units currently furnish only 5 to 35 percent of the requirement, usually 20 percent or less. The situation is expected to ease within five to ten years, after which there should be an adequate supply of pulpwood for all demands. Outside procurement will always be a prominent factor, however, since even when the lands under control are all brought up to full stocking, the usual program envisions only 50 percent of the requirement being furnished by these lands with the remaining 50 percent to be bought on the outside.

Transportation systems and road networks still need great improvement in a number of areas; in other areas, the situation is adequate, or good.

Summary

The visitor cannot fail to be impressed by the great strides that have been made by the industrial foresters of the Southeast, especially within the last ten years. Equally impressive is the energy, time, and money being spent to correct past mistakes in forest land management. There is a strong sense of urgency to get the forest into full production; there is commonly a lack of patience with nature's slowness and unreliability and a substitution therefor of forceful, artificial methods of getting new full stands started. There is above all, the spirit that forestry has come of age and that the forest lands will be handled for the long future for their best use, namely the production of wood in its most useful forms.

Statistics from Schools of Forestry for 1959: Degrees Granted and Enrollments

Gordon D. Marckworth

This article is another in a series of comparable papers appearing annually in the JOURNAL OF FORESTRY *since 1934, reporting the enrollment at the schools of forestry and the numbers of degrees conferred. Statistics of this type were first assembled when the Forest Education Inquiry made its study in 1929-1931, and were published in the Inquiry's report of 1932.*[1] *The annual articles in the* JOURNAL *have brought to date the figures for each successive year.*[2]

THE INCREASE in undergraduate enrollment which began in the 1953-54 scholastic year has continued this year and totals 3 percent, increasing from 7,866 to 8,101—last year the increase was 6½ percent. This is the largest enrollment since the fall of 1948 which totaled 8,212. All classes show an increase in enrollment (Table 6).

General forestry accounts for 71 percent of the enrollment in the combined junior and senior classes; *wildlife management* ranks second with 9 percent and *wood technology and utilization* follows with approximately 5½ percent. The master candidates increased from 537 to 609 and the candidates for the doctorate from 207 to 247. Of the total graduate enrollment of 856, 53 percent are in *general forestry;* 18 percent in *wildlife management;* and 14 percent in *wood technology and utilization.*

The number of bachelor degrees granted increased from 1,362 in 1958 to 1,470 in 1959 of which 1,005 were in *general forestry,* 102 in *wood technology and utilization,* and 144 in *wildlife management.*

The number of master degrees granted increased from 224 to 241 of which 135 were in *general forestry,* 35 in *wood technology and utilization,* and 42 in *wildlife management.*

The number of doctor degrees granted increased from 41 to 43 of which 18 were in *general forestry,* 12 in *wood technology and utilization* and 8 in *wildlife management.*

From 1900 through 1959 there have been 28,254 undergraduate forestry degrees granted in the United States. In addition 5,032 master degrees and 536 doctor degrees have been granted (Table 10).

Introduction

The 1959 statistics from the schools of forestry in the United States are on the same basis as for 1958 except that New Hampshire has been added to the accredited schools, and Arizona State College and Humboldt State College have been added to the non-accredited group. This has increased the number of accredited schools to 28 and the non-accredited schools to 14—a total of 42.

It has been customary to carry the statistics on the number of degrees granted on a calendar year basis and since the reports are requested in October, the schools operating on a quarter basis have to estimate the number of degrees which will be granted at the end of the autumn quarter. It thus becomes necessary to correct these estimates at the end of the year. For this reason the totals listed for 1958 in the current compilation are slightly different from those listed last year.

The statistics on degrees granted and enrollment of graduate students were first broken down by

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[1] Graves, H. S. and C. H. Guise. Forest education. Yale Univ. Press, New Haven.

[2] Guise, C. H. (Eighteen articles on degrees granted and enrollments at schools of forestry in the United States, 1934-1950). Jour. Forestry 32:337-343; 33:402-405; 34:114-120; 35:77-83; 36:12-18; 37:197-202; 38:241-246; 39:359-364; 40:196-202; 41:87-91; 42:357-360; 43:172-175; 44:110-114; 45: 174-180; 46:168-173; 47:93-100; 48:165-169; 49:7-12.

Marckworth, Gordon D. Jour. Forestry 50:262-265; 51:256-259; 52:354-358; 53:256-261; 54:316-321; 55:115-121; 56:129-135; 57:111-116.

TABLE 1.—SIGNIFICANT STATISTICS FOR 1951 THROUGH 1959

	1951	1952	1953	1954	1955	1956	1957	1958	1959
Bachelor degrees conferred	1,564	1,267	1,045	957	829	887	1,172	1,362	1,470
Master degrees conferred	267	226	151	179	194	233	207	224	241
Doctor degrees conferred	21	25	37	44	31	34	44	41	43
Undergraduates enrolled	4,799	4,691	4,909	5,357	6,038	6,933	7,395	7,866	8,101
Members of freshman class	1,370	1,536	1,698	1,986	2,149	2,220	2,230	2,516	2,569
Members of sophomore class	1,107	1,012	1,168	1,377	1,566	1,807	1,831	1,860	1,948
Members of junior class	1,053	1,013	917	1,032	1,236	1,549	1,759	1,718	1,774
Members of senior class	1,269	1,130	1,126	962	1,087	1,357	1,575	1,772	1,810
Graduate students—master	344	281	349	423	405	430	500	537	609
Graduate students—doctor	137	130	139	127	161	165	179	207	247

TABLE 2.—BACHELOR DEGREES GRANTED FOR COMPLETION OF STUDIES IN SPECIALIZED FIELDS AT SCHOOLS OF FORESTRY IN THE UNITED STATES—CALENDAR YEARS 1958 AND 1959

Accredited schools	General forestry		Wood technology		Range management		Wildlife management		Forest recreation		Others		Totals	
	1958	1959	1958	1959	1958	1959	1958	1959	1958	1959	1958	1959	1958	1959
Alabama	19	17	---	1	---	---	---	---	---	---	---	---	19	18
California	31	27	---	---	---	---	---	---	---	---	---	---	31	27
Colorado	15	27	10	2	22	9	25	20	10	11	---	3	82	72
Florida	18	13	---	---	---	---	1	3	---	---	---	---	19	16
Georgia	54	70	---	---	---	---	3	10	---	---	---	---	57	80
Idaho	42	34	---	---	6	9	3	6	---	---	3	5	54	54
Iowa	21	39	7	11	---	---	---	---	---	---	---	---	28	50
La. Poly. Inst.	22	22	---	---	---	---	---	---	---	---	---	---	22	22
Louisiana State	28	37	---	---	---	---	---	---	---	---	---	---	28	37
Maine	34	29	---	---	---	---	9	10	---	---	---	---	43	39
Massachusetts	8	17	---	---	---	---	5	7	---	---	---	---	13	24
Michigan Mining	21	19	---	---	---	---	---	---	---	---	---	---	21	19
Michigan State	35	52	6	1	---	---	20	21	6	4	124	100	191	178
Michigan Univ.	26	21	2	6	---	---	8	15	---	---	6	3	42	45
Minnesota	38	45	---	2	---	---	3	---	---	---	9	3	50	50
Missouri	28	36	---	---	---	---	---	---	---	---	6	2	34	38
Montana	31	30	9	5	---	5	1	4	---	---	---	1	41	45
New Hampshire	11	11	---	---	---	---	3	4	---	---	---	---	14	15
New York	37	44	28	22	---	---	---	---	---	---	29	27	94	93
North Carolina	26	33	6	11	---	---	---	---	---	---	9	10	41	54
Oregon	54	59	9	11	---	---	---	---	---	---	---	---	63	70
Pennsylvania	60	49	8	11	---	---	---	---	---	---	---	4	68	64
Purdue	24	37	4	6	---	---	---	---	---	---	---	---	28	43
Utah	22	33	---	---	21	20	12	30	---	---	---	---	55	83
Washington Univ.	35	45	13	7	---	---	---	---	---	---	---	---	48	52
West Virginia	21	14	4	6	---	---	8	6	---	---	---	---	33	26
Total	761	860	106	102	49	43	101	136	16	15	186	158	1,219	1,314
Schools not accredited														
Arkansas	15	15	---	---	---	---	---	---	---	---	---	---	15	15
Clemson	---	8	---	---	---	---	---	---	---	---	---	---	---	8
Connecticut	9	9	---	---	---	---	2	6	---	---	---	---	11	15
Humboldt	---	15	---	---	---	---	---	---	---	---	---	---	---	15
Illinois Univ.	---	---	---	---	---	---	---	2	---	---	---	---	---	2
Mississippi	37	24	---	---	---	---	---	---	---	---	---	---	37	24
Oklahoma	28	29	---	---	---	---	---	---	---	---	---	---	28	29
Rutgers	4	7	---	---	---	---	---	---	---	---	---	---	4	7
Univ. of the South	4	4	---	---	---	---	---	---	---	---	---	---	4	4
Texas (S.F. Austin)	15	14	---	---	---	---	---	---	---	---	---	---	15	14
Virginia Poly. Inst.	10	4	---	---	---	---	---	---	---	---	---	---	10	4
Washington State	19	16	---	---	---	3	---	---	---	---	---	---	19	19
Total	141	145	---	---	---	3	2	8	---	---	---	---	143	156
Grand total	902	1,005	106	102	49	46	103	144	16	15	186	158	1,362	1,470

specialized curricula in 1953. In 1954 this breakdown was extended to the enrollment of undergraduate students in the junior and senior classes. At that time it was found that there was little segregation during the first two years and a breakdown of the enrollment in those classes would be virtually impossible.

The same five broad classes used for the past five years have been used again this year. These are *general forestry, wood technology and utilization, range management, wildlife management,* and *forest recreation.* Those curricula falling outside of these broad classes have been grouped under the heading *others.*

Each of these classes was described in 1953 (Jour. Forestry 52:354-358) and 1954 (Jour. Forestry 53:256-261), and again in 1957 (Jour. Forestry 56:129-135).

Degrees Granted

During the calendar year 1959 the 42 schools of forestry awarded an estimated 1,470 undergraduate degrees, 241 master degrees, and 43 doctor degrees. Of the total undergraduate degrees 1,314 were awarded by the accredited schools, compared to 1,219 in 1958. In both years these figures represented 89 percent of the total.

Looking at the breakdown of the undergraduate degrees in the specialized fields, we find that 1,005 or 68 percent were in the field of *general forestry.* This compares to 66 percent in 1958 and 1957; and 68 percent in 1956 (Table 2). *Wildlife management* ranked second with 10 percent and *wood technology and utilization* followed with 7 percent, while *others* accounted for 11 percent.

The estimated number of master degrees granted in 1959 totaled 241. *General forestry* accounted for 135 or 56 percent. *Wildlife management* ranked second with 41 or 17 percent and *wood technology and utilization* third with 35. Of the 230 master degrees granted 224 were granted by the accredited schools (Table 3).

The estimated number of doctor degrees granted this year increased from 41 in 1958 to 43. The largest

TABLE 3.—MASTER DEGREES GRANTED FOR COMPLETION OF STUDIES IN SPECIALIZED FIELDS AT SCHOOLS OF FORESTRY IN THE UNITED STATES—CALENDAR YEARS 1958 AND 1959

Accredited schools	General forestry		Wood technology		Range management		Wildlife management		Forest recreation		Others		Totals	
	1958	1959	1958	1959	1958	1959	1958	1959	1958	1959	1958	1959	1958	1959
Alabama	2	...	...	...	...	...	...	...	...	...	...	...	2	...
California	4	12	...	1	...	...	...	...	...	...	...	...	4	13
Colorado	6	4	...	...	...	4	8	5	...	...	...	...	14	13
Duke	15	15	4	2	...	...	...	...	...	...	...	...	19	17
Florida	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Georgia	2	4	...	...	...	...	1	...	...	...	...	...	3	4
Idaho	3	8	...	...	...	1	3	3	...	...	1	...	7	12
Iowa	2	...	2	2	...	...	...	...	...	...	1	...	5	2
Louisiana State	6	5	1	2	...	...	2	3	...	...	...	...	9	10
Maine	1	...	...	...	...	...	1	2	...	...	...	...	2	2
Massachusetts	...	...	...	...	...	...	1	2	...	...	...	...	1	2
Michigan State	10	5	...	...	...	...	4	9	...	...	11	11	25	25
Michigan Univ.	9	7	3	...	...	...	4	6	...	...	6	3	22	16
Minnesota	5	4	...	...	...	...	...	...	...	...	...	...	5	4
Missouri	1	1	...	...	...	...	...	...	...	...	...	...	1	1
Montana	...	2	1	...	...	1	1	1	...	...	...	...	2	4
New York	9	17	10	14	...	...	1	3	...	...	3	6	23	40
North Carolina	3	3	2	3	...	...	...	...	...	...	...	...	5	6
Oregon	16	5	2	2	...	...	...	...	...	...	...	...	18	7
Pennsylvania	3	4	...	5	...	...	...	2	...	...	...	...	3	11
Purdue	2	2	...	...	...	...	...	...	...	...	1	3	3	5
Utah	1	4	...	...	5	...	5	5	...	...	...	...	11	9
Washington Univ.	6	3	1	2	...	...	...	...	...	...	...	...	7	5
Yale	25	29	5	2	...	...	...	...	...	...	...	...	30	31
Total	131	134	31	35	5	6	31	41	...	...	23	23	221	239
Schools not accredited														
Connecticut	...	1	...	...	...	...	...	...	...	...	...	...	...	1
Va. Poly. Inst.	...	...	...	...	...	...	3	1	...	...	...	...	3	1
Total	...	1	...	...	...	...	3	1	...	...	...	...	3	2
Grand total	131	135	31	35	5	6	34	42	...	...	23	23	224	241

TABLE 4.—DOCTOR DEGREES GRANTED FOR COMPLETION OF STUDIES IN SPECIALIZED FIELDS AT SCHOOLS OF FORESTRY IN THE UNITED STATES—CALENDAR YEARS 1958 AND 1959

Accredited schools	General forestry		Wood technology		Range management		Wildlife management		Forest recreation		Others		Totals	
	1958	1959	1958	1959	1958	1959	1958	1959	1958	1959	1958	1959	1958	1959
California	...	1	...	...	...	...	...	...	...	...	...	...	...	1
Duke	2	2	1	...	...	...	...	...	...	...	...	...	3	2
Iowa	...	1	...	...	...	...	...	...	...	...	...	...	...	1
Michigan State	2	...	...	...	...	...	4	1	...	...	1	...	7	1
Michigan Univ.	1	5	...	1	...	...	1	4	...	...	3	3	5	13
Minnesota	2	1	...	...	...	...	...	...	...	...	...	...	2	1
New York	3	2	7	8	...	...	1	2	...	...	...	...	11	12
North Carolina	...	...	1	...	...	...	...	...	...	...	...	...	1	...
Utah	...	...	...	...	...	2	3	1	...	...	...	...	3	3
Washington Univ.	1	1	...	...	...	...	...	...	...	...	...	...	1	1
Yale	4	5	...	3	...	...	...	...	...	...	...	...	4	8
Total	15	18	9	12	...	2	11	8	...	...	4	3	39	43
Schools not accredited														
Virginia Poly.	...	...	...	...	...	...	2	...	...	...	...	...	2	...
Grand total	15	18	9	12	...	2	13	8	...	...	4	3	41	43

TABLE 5.—ENROLLMENT BY CLASSES AT SCHOOLS OF FORESTRY IN THE UNITED STATES FOR THE FALL TERM 1959-1960

Accredited schools	Freshman	Sophomore	Junior	Senior	Total undergraduate	Graduates	
						Master	Doctor
Alabama	110	43	25	26	204	4	—
California	12	16	34	49	111	19	34
Colorado	147	112	86	90	435	29	5
Duke	—	—	—	—	—	48	13
Florida	45	35	25	20	125	4	—
Georgia	60	83	70	99	312	16	—
Idaho	81	74	63	66	284	17	3
Iowa	52	47	51	50	200	4	3
Louisiana Polytechnic Inst.	41	35	27	27	130	—	—
Louisian State	45	7	27	34	113	17	—
Maine	74	51	50	57	232	6	—
Massachusetts	40	25	19	23	107	10	—
Michigan Mining	58	43	37	18	156	—	—
Michigan State	167	112	164	159	602	49	31
Michigan Univ.	20	24	47	53	144	46	49
Minnesota	94	114	76	53	337	25	15
Missouri	60	48	31	35	174	6	—
Montana	101	64	53	81	299	34	—
New Hampshire	21	17	13	13	64	3	—
New York	170	138	86	105	499	86	38
North Carolina	121	95	80	95	391	19	8
Oregon	92	77	95	97	361	19	7
Pennsylvania	127	79	74	83	363	19	—
Purdue	52	38	36	42	168	17	3
Utah	93	93	123	87	396	29	11
Washington Univ.	76	40	79	67	262	25	10
West Virginia	60	82	37	50	229	—	—
Yale	—	—	—	—	—	45	17
Total	2,019	1,592	1,508	1,579	6,698	596	247
Schools not accredited							
Arizona State	54	29	6	—	89	—	—
Arkansas	40	24	24	26	114	—	—
Clemson	107	38	19	11	175	—	—
Connecticut	9	13	9	20	51	5	—
Humboldt	57	48	33	31	169	—	—
Illinois Univ.	38	21	21	6	86	2	—
Mississippi	29	43	43	38	153	—	—
Oklahoma	35	27	35	34	131	—	—
Rutgers	12	15	10	11	48	—	—
Southern Illinois	48	32	14	7	101	—	—
Univ. of South	20	12	7	4	43	—	—
Texas (S. F. Austin)	42	21	14	13	90	—	—
Virginia Polytechnic Inst.	29	16	11	8	64	6	—
Washington State	30	17	20	22	89	—	—
Total	550	356	266	231	1,403	13	—
Grand total	2,569	1,948	1,774	1,810	8,101	609	247

TABLE 6.—UNDERGRADUATE FALL TERM ENROLLMENT BY CLASSES IN SCHOOLS OF FORESTRY IN THE UNITED STATES FOR THE YEARS 1944-1945 THROUGH 1959-1960

Academic years	—Freshman—		—Sophomore—		—Junior—		—Senior—		——Totals——	
	Enrollment	Change	Enrollment	Change	Enrollment	Change	Enrollment	Change	Enrollment	Change
1944-1945	321	+ 122	114	+ 20	64	— 37	72	— 37	571	+ 68
1945-1946	840	+ 519	315	+ 201	205	+141	113	+ 41	1,473	+ 902
1946-1947	3,611	+2,771	1,840	+1,525	914	+709	645	+532	7,010	+5,537
1947-1948	2,061	—1,550	2,878	+1,038	1,577	+663	938	+293	7,454	+ 444
1948-1949	1,851	— 210	2,178	— 700	2,497	+920	1,686	+748	8,212	+ 758
1949-1950	1,485	— 366	1,667	— 511	1,816	—681	2,501	+815	7,469	— 743
1950-1951	1,442	— 43	1,379	— 288	1,384	—432	1,730	—771	5,935	—1,534
1951-1952	1,370	— 72	1,107	— 272	1,053	—331	1,269	—461	4,799	—1,136
1952-1953	1,536	+ 166	1,012	— 95	1,013	— 40	1,130	—139	4,691	— 108
1953-1954	1,698	+ 162	1,168	+ 156	917	— 96	1,126	— 4	4,909	+ 218
1954-1955	1,986	+ 288	1,377	+ 209	1,032	+115	962	—164	5,357	+ 448
1955-1956	2,149	+ 163	1,566	+ 189	1,236	+204	1,087	+125	6,038	+ 681
1956-1957	2,220	+ 71	1,807	+ 241	1,549	+313	1,357	+270	6,933	+ 895
1957-1958	2,230	+ 10	1,831	+ 24	1,759	+210	1,575	+218	7,935	+ 462
1958-1959	2,516	+ 286	1,860	+ 29	1,718	— 41	1,772	+197	7,866	+ 471
1959-1960	2,569	+ 235	1,948	+ 88	1,774	+ 56	1,810	+ 38	8,101	+ 235

TABLE 7.—ENROLLMENT OF JUNIOR AND SENIOR STUDENTS IN SPECIALIZED FIELDS AT SCHOOLS OF FORESTRY IN THE UNITED STATES FOR THE FALL TERM 1959-1960

Accredited schools	General forestry		Wood technology		Range management		Wildlife management		Forest recreation		Others		Totals	
	Jr.	Sr.	Jr.	Sr.	Jr.	Sr	Jr.	Sr.	Jr.	Sr.	Jr.	Sr.	Jr.	Sr.
Alabama	19	18	6	8	—	—	—	—	—	—	—	—	25	26
California	32	48	—	—	2	1	—	—	—	—	—	—	34	49
Colorado	21	23	10	8	18	21	20	29	14	8	3	1	86	90
Florida	20	19	1	1	—	—	4	—	—	—	—	—	25	20
Georgia	65	93	—	—	—	—	5	6	—	—	—	—	70	99
Idaho	41	38	—	—	8	11	11	13	—	—	3	4	63	66
Iowa	46	37	5	13	—	—	—	—	—	—	—	—	51	50
La. Poly. Inst.	27	27	—	—	—	—	—	—	—	—	—	—	27	27
Louisiana State	27	34	—	—	—	—	—	—	—	—	—	—	27	34
Maine	41	40	—	—	—	—	9	14	—	—	—	3	50	57
Massachusetts	14	11	—	1	—	—	5	11	—	—	—	—	19	23
Michigan Mining	37	18	—	—	—	—	—	—	—	—	—	—	37	18
Michigan State	40	46	3	3	—	—	41	24	5	6	75	80	164	159
Michigan Univ.	22	34	2	7	—	—	14	10	—	—	9	2	47	53
Minnesota	66	50	2	—	—	—	—	—	—	—	8	3	76	53
Missouri	30	31	—	—	—	—	—	—	—	—	1	4	31	35
Montana	42	59	1	5	2	8	3	7	4	2	1	—	53	81
New Hampshire	13	10	—	—	—	—	—	3	—	—	—	—	13	13
New York	35	38	15	23	—	—	—	—	—	—	36	44	86	105
North Carolina	49	55	6	13	—	—	—	—	—	—	25	27	80	95
Oregon	85	87	10	10	—	—	—	—	—	—	—	—	95	97
Pennsylvania	63	76	10	2	—	—	—	—	—	—	1	5	74	83
Purdue	29	39	—	2	—	—	6	—	—	—	1	1	36	42
Utah	46	27	—	—	37	23	35	36	5	1	—	—	123	87
Washington Univ.	70	54	9	13	—	—	—	—	—	—	—	—	79	67
West Virginia	29	34	4	5	—	—	4	11	—	—	—	—	37	50
Total	1,009	1,046	84	114	67	64	157	164	28	17	163	174	1,508	1,579
Schools not accredited														
Arizona State	5	—	—	—	—	—	1	—	—	—	—	—	6	—
Arkansas	24	26	—	—	—	—	—	—	—	—	—	—	24	26
Clemson	19	11	—	—	—	—	—	—	—	—	—	—	19	11
Connecticut	2	13	—	—	—	—	7	7	—	—	—	—	9	20
Humboldt	33	31	—	—	—	—	—	—	—	—	—	—	33	31
Illinois Univ.	17	6	4	—	—	—	—	—	—	—	—	—	21	6
Mississippi	43	38	—	—	—	—	—	—	—	—	—	—	43	38
Oklahoma	35	34	—	—	—	—	—	—	—	—	—	—	35	34
Rutgers	10	11	—	—	—	—	—	—	—	—	—	—	10	11
Southern Illinois	14	7	—	—	—	—	—	—	—	—	—	—	14	7
Univ. of South	7	4	—	—	—	—	—	—	—	—	—	—	7	4
Texas (S.F. Austin)	14	13	—	—	—	—	—	—	—	—	—	—	14	13
Va. Poly. Inst.	11	8	—	—	—	—	—	—	—	—	—	—	11	8
Washington State	13	21	—	—	7	1	—	—	—	—	—	—	20	22
Total	247	223	4	—	7	1	8	7	—	—	—	—	266	231
Grand total	1,256	1,269	88	114	74	65	165	171	28	17	163	174	1,774	1,810

TABLE 8.—FALL TERM ENROLLMENT OF WOMEN IN SCHOOLS OF FORESTRY IN THE UNITED STATES FOR THE YEARS 1943 THROUGH 1959

	Freshman	Sophomore	Junior	Senior	Total undergraduates	—Graduates— Master	Doctor
1943	2	..	1	4	7	..	..
1944	5	5	..	1	11	1	..
1945	5	6	5	..	16	1	..
1946	5	5	4	4	18	..	1
1947	1	1	3	4	9	..	..
1948	1	3	1	4	9	2	..
1949	1	1	2	2	6	1	..
1950	2	..	1	4	7	1	1
1951	..	4	..	1	5	..	1
1952	5	2	3	..	10	1	1
1953	8	5	..	3	16	..	..
1954	7	6	3	1	17	2	..
1955	4	5	6	3	18	5	1
1956	8	3	5	4	20	4	5
1957	7	4	5	4	20	4	1
1958	9	7	1	4	21	6	3
1959	6	4	2	4	16	8	..

number, 18 (42 percent) were in *general forestry* (Table 4).

Undergraduate Enrollment

After an all-time high of 8,212 in the fall of 1948, undergraduate enrollment dropped to 4,691 in 1952. Since that date it has increased, and totaled 8,101 this year. The total increase this year is 235 compared to 471 last year and 462 the year before (Tables 5 and 6).

Each class shows an increase this year. However, the total increase is less than it has been since 1953. The increase in both the freshman and senior years is less than it was

TABLE 9.—ENROLLMENT OF GRADUATE STUDENTS IN SCHOOLS OF FORESTRY IN THE UNITED STATES FOR THE FALL TERM 1959-1960

Accredited schools	General forestry		Wood technology		Range management		Wildlife management		Forest recreation		Others		Totals	
	Ms.	Dr.	Ms.	Dr.	Ms.	Dr.	Ms.	Dr.	Ms.	Dr.	Ms.	Dr.	Ms.	Dr.
Alabama	3	—	1	—	—	—	—	—	—	—	—	—	4	—
California	11	27	5	1	—	5	—	—	—	—	3	1	19	34
Colorado	7	—	—	—	4	—	14	—	1	1	3	4	29	5
Duke	35	13	13	—	—	—	—	—	—	—	—	—	48	13
Florida	3	—	—	—	—	—	1	—	—	—	—	—	4	—
Georgia	12	—	—	—	—	—	4	—	—	—	—	—	16	—
Idaho	7	1	—	—	3	1	4	1	—	—	3	—	17	3
Iowa	4	1	—	2	—	—	—	—	—	—	—	—	4	3
La. State Univ.	12	—	1	—	—	—	4	—	—	—	—	—	17	—
Maine	2	—	—	—	—	—	4	—	—	—	—	—	6	—
Massachusetts	1	—	—	—	—	—	9	—	—	—	—	—	10	—
Michigan State	7	16	—	—	—	—	18	14	—	—	24	1	49	31
Michigan Univ.	17	15	4	2	—	—	16	18	—	—	9	14	46	49
Minnesota	20	13	4	2	—	—	—	—	—	—	1	—	25	15
Missouri	6	—	—	—	—	—	—	—	—	—	—	—	6	—
Montana	22	—	3	—	1	—	4	—	2	—	2	—	34	—
New Hampshire	3	—	—	—	—	—	—	—	—	—	—	—	3	—
New York	42	10	19	25	—	—	4	1	—	—	21	2	86	38
North Carolina	11	2	8	6	—	—	—	—	—	—	—	—	19	8
Oregon	16	7	3	—	—	—	—	—	—	—	—	—	19	7
Pennsylvania	13	—	3	—	—	—	3	—	—	—	—	—	19	—
Purdue	11	1	2	—	—	—	1	2	—	—	3	—	17	3
Utah	6	—	—	—	5	5	17	6	1	—	—	—	29	11
Washington Univ.	19	9	6	1	—	—	—	—	—	—	—	—	25	10
Yale	39	14	6	3	—	—	—	—	—	—	—	—	45	17
Total	329	129	78	42	13	11	103	42	4	1	69	22	596	247
Schools not accredited														
Connecticut	—	—	—	—	—	—	5	—	—	—	—	—	5	—
Illinois Univ.	2	—	—	—	—	—	—	—	—	—	—	—	2	—
Va. Poly Inst.	—	—	—	—	—	—	6	—	—	—	—	—	6	—
Total	2	—	—	—	—	—	11	—	—	—	—	—	13	—
Grand total	331	129	78	42	13	11	114	42	4	1	69	22	609	247

TABLE 10.—NUMBER OF DEGREES GRANTED FOR COMPLETION OF STUDIES AT SCHOOLS OF FORESTRY IN THE UNITED STATES FOR THE CALENDAR YEARS 1900-1959

Years	Undergraduate degrees	Master degrees	Doctor degrees
1900	1	—	
1901	5	—	
1902	2	9	
1903	3	14	
1904	9	29	
1905	9	34	
1906	24	24	
1907	19	27	
1908	31	35	
1909	47	44	
1910	61	48	
1911	100	61	
1912	122	54	
1913	136	37	
1914	151	42	
1915	124	35	
1916	151	36	
1917	160	27	
1918	65	10	
1919	53	6	
1920	160	25	
1921	126	26	
1922	141	44	
1923	217	31	
1924	215	43	
1925	280	44	
1926	259	58	
1927	263	50	
1928	302	64	
1929	291	54	
1930	308	69	
1931	394	97	(34)[1]
1932	380	78	7
1933	355	65	6
1934	337	47	6
1935	423	58	8
1936	502	67	9
1937	803	75	7
1938	980	95	5
1939	1,102	112	8
1940	1,072	105	9
1941	834	117	12
1942	654	76	13
1943	446	28	6
1944	106	12	3
1945	51	18	7
1946	192	65	8
1947	553	223	7
1948	918	222	16
1949	1,443	205	12
1950	2,321	275	29
1951	1,564	267	21
1952	1,267	226	25
1953	1,045	151	37
1954	957	179	44
1955	829	194	31
1956	887	233	34
1957	1,172	207	48
1958	1,362	224	41
1959	1,470	241	43
Total	28,254	5,032	536

[1]Total doctor degrees granted prior to 1932. Breakdown by years not available.

last year—the freshman enrollment increase dropping from 286 to 235 and the senior from 197 to 38. The sophomore increase rose from 29 to 88 and junior increase from a loss of 41 to an increase of 56.

Looking at this breakdown by specialized curricula we find that 71 percent of the junior and 70 percent of the senior enrollment were accounted for by those majoring in *general forestry* (Table 7). These percentages are approximately the same as they have been for the past several years. In other words, over two-thirds of the undergraduate enrollment continues in *general forestry* (Table 7). It would also indicate that the bachelor degrees granted during the next two years will continue to account for two-thirds of the total.

Wildlife management ranks second, as it did last year, with 9 percent of the junior and senior classes. *Wood technology and utilization* follows with 5 and 6 per-

cent in the junior and senior classes respectively.

Trends in enrollment are always confused by many factors, and predictions are hazardous at best. Four years ago trends indicated an increase in 1956 of 10 percent which actually totaled 15 percent. The trends for 1957 indicated an increase of 12 percent, but showed an increase of only 7 percent. The trends for 1958 indicated a net increase of 3 percent, but the actual increase was 6½ percent.

Last year I predicted that if present trends continued, the undergraduate enrollment in the fall of 1959 should approach the 1948 all-time high of 8,212. This it did for the enrollment totaled 8,101. Present indications are that there will be only a slight increase next year.

The enrollment of undergraduate women students continues small, totalling 16 this year compared to 21 in 1958, 20 in 1956 and 1957 (Table 8).

Graduate Enrollment

The graduate enrollment is confined to 25 accredited and 3 non-accredited schools. The enrollment for the master degree has increased from 537 to 609, and the doctorate from 207 to 247 or a combined increase from 744 to 856. Of these 53 percent are in *general forestry;* 18 percent in *wildlife management;* and 14 percent in *wood technology and utilization.* The accredited schools account for 596 of the 609 master candidates and all of the doctor candidates.

Among the accredited schools 329 of the 596 master candidates were enrolled in *general forestry,* 103 in *wildlife management,* and 78 in *wood technology and utilization.* Among the non-accredited schools out of a total of 13 candidates, 11 were in *wildlife management* and 2 in *general forestry* (Table 9).

The total enrollment for the doctorate is in the accredited schools and shows 129 in *general forestry,* 42 in *wood technology and utilization,* and 42 in *wildlife management* (Table 9).

Of the 856 graduate students enrolled throughout the nation only eight are women, and all are candidates for the master degree (Table 8).

A Test of Gibberellic Acid on Longleaf Pine

In reading Westing's recent article[1] we noted that no published results of trials of gibberellic acid on longleaf pine had been located. In the hope of remedying this deficiency, we submit the following negative results of a test conducted at the U. S. Forest Service's Lake City Research Center.

In March 1957 a 200 ppm. (5.8×10^{-4}M) solution of gibberellic acid was used to test the response of longleaf seedlings to a dip in this growth regulator. Four treatments were tested: (1) dipping the entire plant, (2) dipping the root system only, (3) dipping the foliage to the root cellar, and (4) an untreated check. A total of 240 seedlings was used, 60 in each treatment. Six blocks of four randomized rows, each containing 10 seedlings, were planted. Each block was treated and planted separately.

Four months after planting, seedling survival and vigor were checked. At that time the survival percentages in the treatments listed above were 45, 62, 68, and 88 percent, respectively. The differences were significant at the 1-percent level of probability. The seedlings which had received no treatment had the most vigorous appearance.

In the press of other work negative results sometimes receive less attention than they deserve. Author Westing is to be commended for making an effort to prevent repetition of efforts in unpromising lines of research.

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[1]Westing, Arthur H. Effect of gibberellin on conifers: generally negative. Jour. Forestry 57:120-122. 1959.

Sprouting of Loblolly Pine

S. Little and H. A. Somes

THE COMMON BELIEF has been that loblolly pine sprouts little, if at all. For example, Grano (*2*) stated that young shortleaf pines sprout after being severely damaged, while loblolly pines do not. Little (*3*) has said that sprouting in this species is negligible. However, rabbits clip thousands of loblolly pine seedlings each year, and, as Wakeley (*7*) noticed, many of these recover.

Under what conditions and to what age may loblolly pine sprout? This paper, which is based on observations of seedlings purposely clipped, attempts to answer that question.

Sources of Sprouts

Loblolly pine seedlings may produce sprouts from two sources. One is buds at the nodes;[1] the other, dwarf shoots or the sites of dwarf shoots. Of these two possible sources, the latter is by far the more important.

In his monograph on pines, Doak (*1*) pointed out that fascicles are specialized, deciduous dwarf shoots that differ from long shoots. In some dwarf shoots he found no trace of tip meristems; in others he found growing points that graded from minute simple domes of meristematic tissue through buds in varying stages of development to well-developed scaly ones. He also found indications that some dwarf-shoot buds grow slowly from year to year without actually extending to form branches.

According to the Stones (*6*), each of the axils of the lower primary needles on the seedling stem contains meristem that is potentially capable of producing a needle fascicle, a shoot, or a dormant bud. In loblolly pine, buds develop in a variable number of the primary needle axils. Some of the buds elongate soon after formation, whereas others remain dormant for a time (*6*).

The proportion of axils that develop needle fascicles, as well as the height at which the first fascicles are formed, varies with growing conditions. Most loblolly pine seedlings growing under relatively unfavorable conditions in the wild develop only primary needles on the lowest 6 inches of their stems or, at most, only a few fascicles. In contrast, fertilized and watered nursery seedlings may develop numerous needle fascicles in the axils of primary needles, starting as low as 2 inches above the cotyledons.

Even so, given a suitable stimulus, both types of seedlings may develop new shoots. Fascicle buds, dormant axillary buds, and meristematic growing points all have the potential to elongate so long as the meristem is viable.

Unlike pitch pine, loblolly pine seedlings do not normally develop large basal branches along the lowest 5 inches or so of stem (Fig. 1). Above that height, some nodal buds usually elongate with or soon after the terminal bud so that conspicuous branches are formed. But on the basal portion of the stem, es-

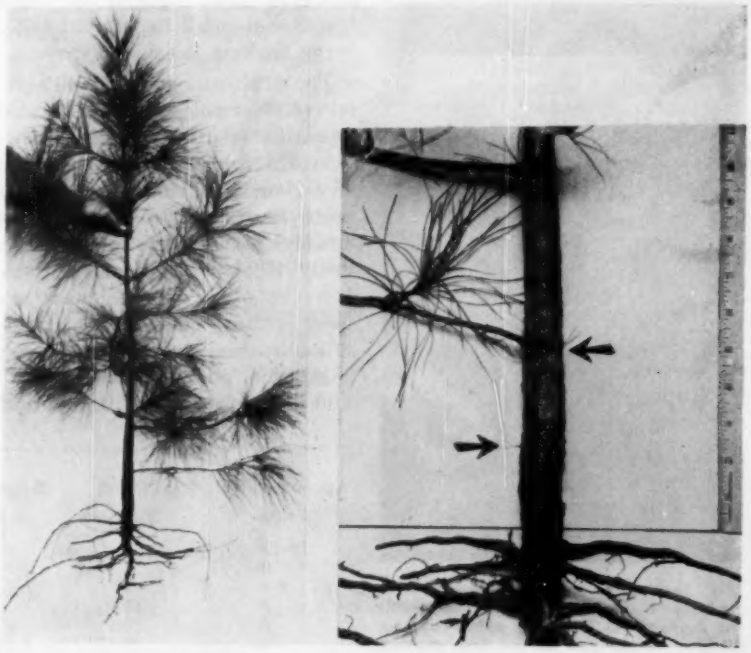

FIG. 1.—Branch development of a typical loblolly pine seedling. *Left*, overall view: notice the absence of basal crook. *Right*, in this close-up notice the stunted branches (one on the right side of stem at 5 inches, one at left at 2 inches), each having only one or two needle fascicles.

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[1]Node in this paper means, as in most forestry literature, the point on the stem at which normal lateral buds occur or have occurred (*5*). It marks the end of a stage of height growth.

pecially in natural reproduction, branch buds are slow to appear and seldom develop into more than stunted branches or twigs. Some may be so stunted that they bear only one or two needle fascicles (Fig. 1). While such branches vary in number, they are restricted to a short distance above the cotyledons —usually 2 to 4 inches. We do not know how many of these start as nodal buds; but we surmise, from their slow appearance and scattered locations, that most originate at dwarf-shoot sites.

Buds Prerequisite to Sprouting

For either loblolly or other pine species to sprout and recover after death of the stem, an absolute requirement is that a sector of stem above the original position of the cotyledons remain alive. This is so because sprouts can develop only from dormant buds, bud-bearing fascicles or dwarf shoots, or possibly from meristematic bud primordia, all of which originate either in a primary needle axil or at a node. Pines, in common with many other species, seem incapable of generating stem primordia from tissues of the hypocotyl or of the roots.

FIG. 2.—Sprouts from a 6-year-old loblolly pine seedling. Above: in the middle of July, about 2 months after clipping. Below: at the end of the first growing season. Even at that time, sprouts from some stumps of this age were no more advanced than those shown in the upper photo.

To demonstrate this basic principle of sprout origin, we clipped 100 loblolly pine seedlings in November 1954. Fifty seedlings were of 1954 origin and 50 were of 1953 origin; 25 of each age group were clipped below the cotyledons and 25 about 1 inch above. When examined the following May, none of the seedlings clipped below the cotyledons showed any sign of recovery. In contrast, 72 percent of the 1-year seedlings and 48 percent of the 2-year ones clipped above the cotyledons were developing new shoots. In a later test in which twenty 1-year and twenty 2-year seedlings were clipped to leave longer stubs (0.2 to 0.3 foot tall), every seedling developed sprouts.

The same principle has been observed among natural and planted 1-year-old seedlings clipped by rabbits. On the natural reproduction of certain areas, many of the cuts are so low that little or none of the epicotyl is left, and seedling mortality is high. Planted seedlings, however, often are set lower than their natural position; when rabbits clip these low-set seedlings, a substantial piece of epicotyl is left and most of such seedlings sprout.

Notable, too, are differences in the usual origin of sprouts. Planted seedlings, as part of their nursery heritage, commonly bear many needle fascicles along the first-year juvenile stem; here fascicles are the usual source of sprouts after clipping. On the other hand, fascicles commonly are sparse or absent on the lower juvenile stem of wild seedlings; when these seedlings recover from clipping, the sprouts originate mostly from dormant axillary buds or meristematic bud primordia.

When the green tops or tops and stems of young loblolly pines are killed by fire, the trees cannot be expected to recover. Loblolly differs from pitch and shortleaf pines in that: (1) it does not normally develop a basal crook, which in the latter two species protects dormant basal buds by bringing them in contact with the ground; and (2) it does not have dormant buds, protected by thick bark, along the bole. These protective adaptations commonly enable pitch and shortleaf pines to produce basal and bole sprouts after fires of moderate intensity (*4*, *6*), whereas loblolly pines—even seedlings—in similar situations do not sprout because their comparatively unprotected basal buds are easily killed.

Sprout Vigor and Persistence Decline with Seedling Age

The ability of loblolly pine to produce sprouts decreases rapidly with age. In our observations, seedlings more than 8 years old did not even start to sprout after severance of stems about 0.4 foot above ground, while nearly all seedlings 1 or 2 years old sprouted after similar cutting. Here are our observations on initial sprouting:

Age of seedling	Clipped	Height of cut	Date cut	Sprouted
Years	*Number*	*Feet*		*Percent*
10–13	6	0.4	May 1958	0
9	6	0.4	May 1958	0
7–8	8	0.4	May 1958	25
6	15	0.4	May 1958	80
5	20	0.4	April 1957	55
4	20	0.2–0.4	April 1957	60
3	20	0.2–0.4	April 1957	80
3	20	0.2–0.3	April 1956	80
2	20	0.2–0.3	April 1956	100
1	20	0.2–0.3	April 1956	100

More 6-year-old seedlings sprouted in 1958 than 5-year-old seedlings in 1957. Possibly the more favorable growing season in 1958 caused this difference permitting relatively weak buds to develop shoots (Fig. 2).

Not all seedlings that sprout survive, and mortality seems to increase with age. For example, we found no living sprouts at the end of the first growing season on seedlings that were older than 6 years when clipped. While 73 percent of the 6-year-old seedlings clipped in May had living sprouts in October, most of these were weak (Fig. 2). Probably only an occasional one will survive.

Of the 5-year-old seedlings, only one (5 percent) had living sprouts at the end of the second growing season (Fig. 3). Although 35 percent of the 3-year-old seedlings clipped in 1957 had living sprouts at the end of their second growing season, only 5 percent of the 3-year-old seedlings clipped a year earlier had living sprouts during their third growing season. In contrast, 90 percent both of the 1-year-old and 2-year-old seedlings clipped in 1956 had living sprouts during their third growing season.

Since needle fascicles generally were absent below the cut on the experimental seedlings of all ages, there were practically no sprouts of fascicle origin. Nearly all the observed sprouting apparently came from basal buds, most of which were probably in needle-fascicle (or dwarf-shoot) sites. In the youngest seedlings, those 1 or 2 years old, no buds were easily visible before clipping, but later inspection indicated that either minute buds or meristematic bud primordia probably were present but hidden within the bark.[2] In many of the older seedlings, sprouting was from visible buds. In some instances, a few of these buds had developed into minute branches that protruded ¼ to 1 inch beyond the bark and possibly bore one or two needle fascicles—such as those shown in Figure 1.

These minute branches or elongated buds are a more important source of sprouts in seedlings older than 3 years than in younger ones. None of the sprouts from 3-year-old seedlings were attributed to that source. However, some of the shoots on 17 percent of the 4-year-old seedlings and on 73 percent of the 5-year-old seedlings, and all sprouts on the 7- and 8-year-old seedlings, arose from such minute branches.

Summary

In Maryland loblolly pines up to 7 or 8 years of age may sprout after severance of the stem. Most sprouts start from dwarf-shoot sites: from buds or meristem formed in the axils of primary needles, from needle fascicles, or from minute branches originating in these axillary sites. However, nodal buds also probably produce an occasional sprout. Sprouting therefore can occur only if a portion of bud-bearing epicotyl remains after the cut. Loblolly pines do not sprout after fire because the buds are all situated above ground and thus are easily killed. Sprouting vigor declines with increasing seedling age over 2 years, and sprouts that do start on 3-year and older seedlings mostly die off.

[2] An anatomical study of the origin and development of basal buds, now being planned, should provide the basis for more definite statements than can now be made.

FIG. 3.—Two-year-old sprouts produced by clipping a 5-year-old loblolly pine seedling. (Pencil rests on top of the stump.)

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Site Index for Planted Red Pine by the 5-Year Growth Intercept Method[1]

M. W. Day, C. F. Bey, and V. J. Rudolph

RED PINE (*Pinus resinosa* Ait.) is one of the more valuable coniferous species in the Lake States, and is continuing to be widely used in reforestation. While at the present time red pine stands occupy slightly less than one million acres, the plantable area in the three states exceeds eight million acres, and much of it is suitable for red pine. The reforested area and the importance of red pine are therefore likely to increase. Many red pine plantations are growing on soils which are more productive than those on which red pine occurs naturally. This condition suggests a need for additional study of site quality relationships for red pine.

The quality of a given forest site is determined by a complex of soil, climatic, and other factors. No single factor has been found to correlate sufficiently with tree growth to serve as a reliable measure of site quality. The use of plant indicators is recognized as a valuable method of forest site quality classification in some instances. The most commonly used measure of site quality is site index, which is the average height attained by dominant and codominant trees in relatively pure, even-aged, well stocked stands at some reference age. For eastern species, such as red pine, the reference age is 50 years.

The 5-year growth intercept method of site quality evaluation is a relatively new technique. Ferree, Shearer and Stone (*2*) have proposed use of this method in young plantations until they become old enough to permit the calculation of conventional site indexes.

The purpose of this study is to determine the relationship between the results obtained by the 5-year growth intercept method of evaluating site quality and the results obtained by the conventional height-over-age site index method for red pine.

Of necessity, American site index curves have been derived from temporary sample plot data. This approach involves determining the average ages and heights of the dominant and codominant trees in many stands, fitting a single average regression curve of height on age, and drawing higher and lower harmonized curves.

The limitations and inaccuracies of this method are many. It assumes that the curves for the poorest sites have the same growth pattern as those for the best sites. According to Bull (*1*), proper growth curves can be obtained only by plotting individual growth curves for a given site. The process of harmonizing site index curves assumes that site differences as expressed by growth are apparent at an early age. If one site produced a taller tree at age 50 than another site, the assumption is made that the tree was taller on the better site at all preceding ages, and will be taller at all subsequent ages than the tree on the poorer site.

The height-over-age method is inaccurate in stands where dominant and codominant trees have been affected by past suppression, in extremely dense or very open stands where stagnation or excessive crown development are observed (*3*), and in stands where certain cuttings such as thinning from above have been made.

The use of red pine site index curves presently available (*3*) is limited to stands at least 20 years old. Below this age, the curves are subject to increasing error, and cannot be considered reliable. In young stands, an error in the total age seriously affects the site index determination. The large variability in the establishment period is a major source of error when this method is applied to young stands.

When the planting date is not known, it is often difficult to determine the total age. The number of nodes on the lower portion of the tree cannot be counted accurately, and the estimate of age by counts of annual rings on increment cores is scarcely better.

Because of the difficulty in measuring total heights, especially in dense stands 25 to 35 feet or more in height, site index data are frequently not obtained, or are not obtained accurately. Thus, the published information on stand growth and development of red pine which is available for various site indexes is not utilized in plantation evaluation and management.

The 5-year intercept method of site quality evaluation is based on two assumptions. It assumes that height growth made by each tree for 5 years beginning with the attainment of breast height can be measured easily and accurately. It also assumes that once trees of a given species and at a wide range of plantation spacings have reached breast height on comparable sites, they will grow at essentially comparable rates for the next 5 years

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[1]Journal Article No. 2479 from the Michigan Agric. Expt. Sta.

TABLE 1.—DISTRIBUTION OF PLOTS BY LOCATION AND INTERCEPT CLASS

Forest name and location	2.50 to 3.49	3.50 to 4.49	4.50 to 5.49	5.50 to 6.49	6.50 to 7.49	7.50 to 8.49	8.50 to 9.49	9.50 to 10.49	10.50 to 11.49	11.50 to 12.49	Total
Dunbar Forest, Sault Ste. Marie, Mich.	..	..	..	..	..	3	2	..	..	..	5
Stinchfield Woods, Pinckney, Mich.	..	..	..	..	..	..	2	2	1	..	5
Kirkwood Forest, Thessalon, Ontario	..	..	..	2	1	2	1	..	..	..	6
Kellogg Forest, Augusta, Mich.	..	..	..	..	..	..	1	..	..	2	3
Lake Superior State Forest, Newberry, Mich.	..	1	..	..	..	..	..	..	..	..	1
Huron National Forest, Tawas City, Mich.	1	2	1	..	1	..	..	..	..	..	5
Marquette National Forest, Raco, Mich.	3	4	3	..	2	..	4	..	..	..	16
Marquette National Forest, St. Ignace, Mich.	..	..	..	2	1	1	1	..	..	..	5
Mackinac State Forest, Rexton, Mich.	..	..	..	3	1	..	..	..	..	..	4
Kimball Forest, Battle Creek, Mich.	..	..	..	..	..	..	1	..	1	..	2
Kiwanis Forest, Dafter, Mich.	..	..	..	..	..	..	..	2	2	..	4
Total	4	7	4	7	6	6	12	4	4	2	56

or more, whereas on contrasting sites they will grow at consistently contrasting rates.

Previous Work

In 1931, Bull (*1*) tested a method similar to the 5-year intercept method. He determined the number of years required for a tree to grow from 3 feet to 9 feet above the ground, as well as the number of years to grow other internal lengths. He reported that this method gave very erratic and unsatisfactory results. Wakeley and Marrero (*5*) are the pioneers of the 5-year intercept method. As early as 1937, Wakeley proposed the method. Later, Marrero tested the method on 4 southern pine species. He concluded that generally the 5-year intercept lengths were significantly correlated with total height. Warrack and Fraser (*6*) found the relationship between site index and the 3- and 5-year intercept lengths in juvenile Douglas-fir to be highly significant. Ferree, Shearer, and Stone (*2*) studied young red pine plantations and demonstrated that the 5-year intercept can be a reliable indicator of growth in the next 15 to 20 years. They did not, however, express their results in terms of conventional site index units.

Description of Study Area

Data for this study were collected from both Upper and Lower Michigan, and adjacent Ontario, Canada. The general location of the plots is indicated in Table 1 showing the range of sites sampled.

The climate of the area varies considerably, and is quite typical of the variation over most of the Lake States range of the species. The average January temperature varies from 14° F. in the northern part to 24° F. in the southern part of Michigan. The average July temperature varies from 62° F. to 72° F. Annual precipitation averages from 30 to 34 inches over the area studied. The average frost-free season varies from 120 to 160 days.

The majority of the stands investigated are the results of CCC planting in the 1930's. The land had a variety of past uses, but much of it was abandoned farm land or cutover and burned forest land before planting.

The soils of the stands examined range from coarse to very fine sand and sandy loams. In all cases, the soil was covered with a layer of needles from 2 to 3 inches thick in the northern stands, and somewhat less in the south.

The lesser vegetation in all stands was very sparse. A few grasses and other herbaceous plants were found in the majority of the stands. In no stand was any red pine reproduction found. A few of the plantations which were adjacent to hardwood stands contained a small amount of hardwood reproduction.

Field Procedure

The plots were all located in pure red pine stands. The main emphasis in plot selection centered on finding an area with uniform site conditions. Areas which contained small pot-holes or knolls were avoided. Ten dominant and codominant trees were selected at random within a ¼-acre area. Since most plantations examined were relatively young, the distinction between dominant and codominant trees was very small. No attempt was made to take a certain number of trees from each crown class. All trees which were obviously deformed or injured were rejected. No measurements were taken in any stand in which the total age was less than 20 years. The ages of the plots taken are shown in Table 2.

The 56 plots were taken in 40 different red pine stands covering a wide range of site quality. Actually, many more red pine plantations were examined during the study. In order to keep the sam-

TABLE 2.—DISTRIBUTION OF AGES BY PLOTS

Age, years	No. of plots
21	1
22	10
23	8
24	2
25	3
26	3
27	6
28	4
29	4
30	1
31	2
32	8
34	1
38	3
Total	56

pling balanced through the range in site quality, special efforts were made to limit the sampling to 2 or 3 plots in stands which were obviously similar in regard to site quality and age.

Data Collected

The measurements and information which were recorded in the field included:

1. *Location.*
2. *Age.* — Where possible the age of the stand was obtained from planting records. In other cases, the age was obtained by taking an increment boring at the base of the tree, or by counting the total number of branch whorls present. The age is considered to be the age since planting. From planting records examined, most trees planted were of 2-0 stock.
3. *Age at breast height.*—The age at breast height was determined by counting the number of whorls above breast height and subtracting this from the total age.
4. *Total height.* — The height was recorded to the nearest foot.
5. *Five-year internodal distances.*—The internodal distances for a 5-year period beginning with the first node above breast height were recorded. A calibrated bamboo pole was tied to the tree. The observer then stood approximately 20 feet from each tree and recorded the heights at the 6 specified nodes. The individual and total intercept distances were computed in the office later.
6. *Supplemental information.*—The approximate spacing, general condition of the stand, past treatment, general soil characteristics, slope, and exposure were recorded.

Analysis of Data and Results

Influence of the establishment period.—The average time required for sample trees of each plot to reach breast height was plotted over the height growth for the 5-year period beginning with the first node above breast height (Fig. 1).

From 6.0 to 13.8 years after planting were required to reach the breast height level. A straight line regression fitted by the least squares method results in a very slight negative slope to the curve ($b_{yx} = -.1755$). Further examination of the data revealed a very weak correlation coefficient ($r_{yx} = -.2448$). An analysis of variance test showed the above data not to be significantly different from zero. This indicates that the site factors which determine and influence the establishment time are not significantly correlated with the growth for the 5-year period following attainment of breast height. In other words, there are special factors which exert an influence upon the establishment time. Presumably these consist of such factors as planting stock quality, planting technique, initial competition, surface soil characteristics, degree of natural or artificial protection, and degree of frost or animal injury. It is evident, therefore, that the inclusion of height-age data from below breast height injects a large and unrelated error into site index calculations.

Relationship of site index and 5-year intercept.—The average site index for each plot was determined by the conventional height-over-age method, using the site index curves for red pine in the Lake States (*3*). In each plot, the individual 5-year internodal lengths were averaged. The average site index for each plot was plotted over the average 5-year internodal growth (Fig. 2).

The range of site indexes extended from 33 to 88. To obtain some of these from the source listed above required the formation of lower and higher site index curves, and interpolation between the curves. The additional curves were based on the assumption that the higher and lower curves would follow the same form as the existing curves. Over this range of site indexes, the average 5-year internodal lengths per plot extended from 2.51 to 11.79 feet.

A straight line linear regression was fitted to the data by the least

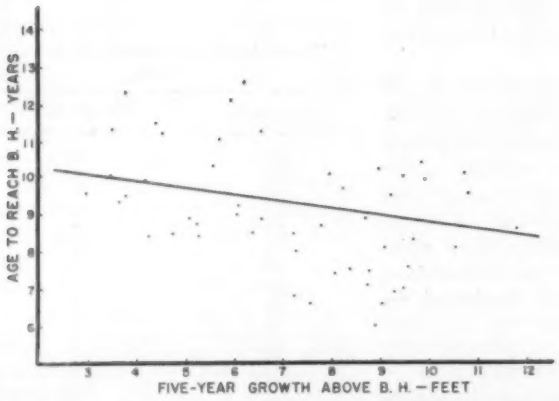

FIG. 1.—The relationship of age at breast height and 5-year height growth above breast height for red pine.

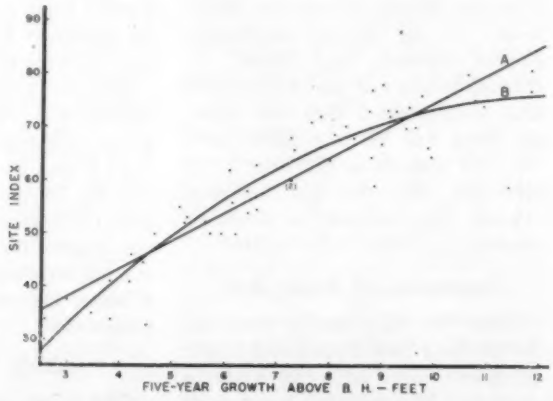

FIG. 2.—The relationship of site index and internodal lengths for red pine.

squares method using the equation

$$Y=a+bx$$

in which

Y=the site index

x=the 5-year intercept in feet.

The results showed a to be 23.12, and b to be 5.17 (curve A in Fig. 2). This means that for each unit of 5-year internodal length above breast height (in this case one foot), the site index will change by 5.17 site index units. For example, if the difference in average 5-year internodal length between two stands is 3 feet, the site index would differ by approximately 15.5 units.

The standard error of the estimate, a measure of the dispersion of the individual values from the regression line, was calculated to be 6.39 expressed in site index units. A correlation analysis showed the correlation coefficient to be .8939. The correlation coefficient is simply a measure of the degree of association of the estimated site index values with that of the 5-year intercept values. The correlation coefficient squared, here equal to .7991, means that approximately 80 percent of the variation in site index units is associated with the variation in the 5-year internodal length values above breast height. An analysis of variance test showed the slope of the curve and the correlation coefficient to be highly significant.

A test for the linearity of the regression showed the data to be not significantly different from a straight line relationship. However, a curvilinear regression was computed, using the equation

$$Y=a+bx+cx^2$$

in which

Y=the site index

x=the 5-year intercept in feet.

The results showed a to be $-.0002$; b to be 12.5290; and c to be $-.5166$ (curve B in Fig. 2). The standard error of the estimate was computed to be 5.66 site index units.

The correlation index, analogous to the correlation coefficient, was .9180 for this curve. An analysis of variance test of the correlation index revealed it to be highly significant. The correlation index is a measure of the degree of association between the estimated site index values and the 5-year intercept values. The correlation index squared, equal to .8427, means that approximately 84 percent of the variation in site index is associated with and can be estimated by the 5-year intercept of the tree. Failure to attain a higher degree of association may be largely attributable to the effects, upon growth below breast height, of influences other than site.

The entire data showing differences in height-over-age site index values, and site index values estimated from 5-year intercept values, are presented in Table 3.

Estimated site index values for various 5-year intercept values were computed by the curvilinear regression equation, and are presented in Table 4. Simple interpolation will yield estimates of site index for fractional intercept values.

TABLE 3.—DISPERSION OF HEIGHT-OVER-AGE SITE INDEX VALUES FROM SITE INDEX VALUES ESTIMATED BY THE CURVILINEAR REGRESSION (FIG. 2)

	No. of plots	Percent	Cumulative percent
Within ± 2 units of estimated site index	24	42.9	42.9
Within ± 4 units of estimated site index	12	21.4	64.2
Within ± 6 units of estimated site index	12	21.4	85.6
Within ± 11 units of estimated site index	6	10.7	96.3
Within ± 16 units of estimated site index	2	3.6	100.0
Totals	56	100.0	

Discussion

This study correlates the results of using the 5-year intercept method of evaluating site quality for red pine with the results obtained by the conventional height-over-age approach. The data on growth, yield, and stand characteristics which have been compiled for red pine for various conventional site index classes can now be used in evaluating and managing stands for which the site index has been determined by the 5-year intercept method.

Many of the weaknesses inherent in the conventional height-over-age site index method are also incorporated into the 5-year intercept estimated site index values. This is an unfortunate but inevitable circumstance. As long as the 5-year intercept measurements are converted into conventional site index values, the resulting estimates are not free from some of the disadvantages detailed in connection with indexes based on total height and total age. The value of the 5-year intercept method, as presented in this report, centers on the ease and convenience of determining site index values, and the ability to evaluate younger stands. The only measurement required for site index determination is that of the 5-year growth intercept. With this method, the site index of any stand which has grown for a 5-year period beyond breast height can be evaluated.

Summary

The most frequently used site index for a given species is that based on total height attained at a given age. The height-over-age

TABLE 4.—ESTIMATED SITE INDEX VALUES BASED ON 5-YEAR INTERCEPT LENGTH

5-year intercept length	Estimated site index
Feet	*Feet*
3	33
4	42
5	50
6	57
7	62
8	67
9	71
10	74
11	75
12	76

curves derived by this method have many disadvantages. The new technique of using the 5-year growth intercept will reduce the amount of work required in obtaining site index values. It will also permit site index classification of any stand which has grown for a 5-year period beyond breast height.

The purpose of this study has been to determine the relationship of conventional site index obtained by the height-over-age method to the 5-year growth intercept beginning with the first node above breast height.

The data were collected from 56 plots in 40 different red pine stands over a wide range of site conditions in Michigan and adjacent Ontario. Ten dominant and codominant trees were selected at random within a ¼-acre area. A special effort was made to obtain a uniform number of plots in the wide range of site qualities occurring in the study area. The measurements and information which were recorded in the field included the location, total age, age at breast height, total height, 5-year internodal distances, and other general stand characteristics.

The average time required for sample trees of each plot to reach breast height varied from 6.0 to 13.8 years. An analysis of variance of the regression line showed that the time required to reach breast height was not significantly correlated with the 5-year intercept. This indicates that there are special factors other than site quality factors which exert an influence upon the establishment time required to attain breast height.

The range of site indexes, determined by the conventional height-over-age method, extended from 33 to 88. Over this range of site indexes, the average 5-year intercept lengths per plot extended from 2.51 to 11.79 feet. A straight line regression fitted by the least squares method revealed a curve with a slope of $b_{yx} = 5.17$. A correlation analysis test showed the correlation coefficient equal to .8939. An analysis of variance test shows the slope of the curve and the correlation coefficient to be highly significant.

Although the data could not be shown to be significantly different from a straight line relationship, a curvilinear regression was fitted to the data. For this curve, the standard error of the estimate equaled 5.66 and the correlation index .9180. The correlation index squared, equal to .8427, means that approximately 84 percent of the variation in total height is associated with variation in the length of the 5-year intercept. An analysis of variance test showed the correlation index to be highly significant.

Reliable conventional site index estimates can be obtained by using the 5-year growth intercept method. This approach simplifies the task of determining the site index for a given stand, and also permits the determination of site index in young stands, even in those which have grown for only 5 years beyond breast height.

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Errata

On page 79 (January JOURNAL OF FORESTRY) the name of J. M. Tinker should be listed under "Georgia." His listing is given alphabetically in the directory of Consulting Foresters.

On page 77 under Tree Farm Management Service, Inc., add name of Lyle H. Seymour and delete that of H. N. Cory.

Appraising White-Pine Weevil Control Opportunities

Robert J. Marty and Glenn R. Allison

THE ADVENT of methods for controlling white-pine weevil injury has introduced a new way of increasing the yield and value of eastern white pine (*Pinus strobus* L.). But this new opportunity brings with it a new problem: foresters must decide when and where to attempt control.

As a general principle, control should be undertaken in those situations where it is the most efficient means of meeting management objectives.[1] Two steps are essential in assessing weevil control opportunities: *stating control objectives* and *comparing alternate means* of reaching these objectives.

This paper describes how the Department of Conservation plans to use these two steps in developing a weevil-control program in New York State. It illustrates how objectives can be defined and alternatives compared.

A Weevil-Control Program for New York

Early in the 1930's many New York foresters concluded that white pine could no longer be considered a good investment choice despite its excellent growth potential, adaptability, and high value. The ubiquitous and often severe damage caused by white-pine weevil (*Pissodes strobi* [Peck]) and blister rust (*Cronartium ribicola* [Fischer]) made profitable management doubtful.

Since then blister-rust control has proved to be an effective means of reducing damage from this source. And recent developments in weevil control promise to remove much of the threat of this second major bane of eastern white pine. A method of applying insecticides effectively with hand equipment in young stands has already been developed (*2*). And continuing research in the aerial application of insecticides (*1*) indicates that control procedures for larger areas and older stands has reached the pilot testing stage.

With effective weevil-control measures in sight, renewed interest is being shown in white pine. This interest resulted in a decision by the state forester to investigate the benefits that might be gained from a weevil-control program in selected stands in New York. The decision was possible because New York has legislation enabling the state government to participate in cooperative pest-control programs, and because the Bureau of Forest Pest Control, Division of Lands and Forests of the Department of Conservation, was available to develop and implement the program.

Stating Program Objectives

The Bureau of Forest Pest Control has the broad goal of increasing forest values by controlling forest pests. Weevil control is one way of attaining that broad goal. The bureau first had to determine where control was feasible. Then they had to identify those weevil-control opportunities that will yield the greatest return.

In deciding where control might be undertaken, the bureau had to consider its own capabilities and the extent of current control knowledge. An initial conference was called to review research knowledge and to muster available experience in weevil-control programming. Participating in the conference were representatives of the New York State Department of Conservation, the New York State Science Service, the U. S. Forest Service, and the Pennsylvania Department of Forests and Waters.

As a result of this and subsequent conferences, the bureau selected several immediate objectives. The initial program was to be a cooperative state and federal venture to test the feasibility of weevil control on a large scale. It would be restricted initially to (1) two New York Forest Districts; (2) state or county land; (3) white pine plantations; (4) plantations currently less than 20 feet in average total height; and (5) 90-percent-effective aerial insecticidal control, that is, protection that would result in 90 percent of the crop trees developing one 16-foot log without weevil injury during the subsequent 16 feet of height growth.

Why Objectives Were Limited

The two selected districts contain a large amount of planted white pine in which weevil damage had been severe. These districts would provide a stringent test of aerial control techniques. If successful, the program could be extended to other Forest Districts. Information and techniques developed would be made available to private forest managers.

The initial program was restricted to plantation white pine for a number of reasons. The existing aerial control techniques could be better tested in plantations than in natural stands. White pine plan-

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[1] For a more complete discussion of this general principle as it applies to forest management of all types, see Carl Stoltenberg. An investment-opportunity approach to forestry programming. Jour. Forestry 57:547-550. 1959.

tations are a small but important part of the total white pine resource in New York; they have sustained greater weevil damage than have natural stands; and it appeared likely that plantations offered the best control-investment opportunities.

Then, too, interest in plantations is inherent with foresters and forest land owners. Successful control here would attract considerable enthusiasm. And finally, plantation location, acreage, and inventory data were readily available—these would facilitate program planning. As control techniques improve and control experience is accumulated, control can be extended to natural stands and to infested Norway spruce plantations.

The test program was designed to include only those stands currently less than 20 feet tall since the greatest benefit from weevil control occurs in young stands. This is true because the lower portions of the bole contain the majority of potential harvest volume. In older stands, already weeviled, the best control opportunities have been lost.

Last, control was to extend through the next 16 feet of height growth. And weevil injury was to be reduced so that no more than 10 percent of the stems would be injured within this protected section.

In this way explicit weevil-control objectives were formulated. They were consistent with current knowledge and organizational capacity, and with the bureau's broad goal. They identify the potential control sites, each of which was an opportunity for increasing forest value and productivity through weevil control.

Evaluating Control Opportunities

The next step was to develop a method of assigning priorities to these many opportunities. By relating control costs to anticipated returns, a system of priorities could be developed. Dividing value saved by the cost of control in each plantation would provide an estimate of the return that could be earned per dollar of control investment.

Let us first consider the returns. Weevil control brings two types of saving: added merchantable volume and increased quality (*5*). To estimate the value of these savings, we need to know the volume that can be saved by control, the accompanying increase in quality, and their current dollar value.

The volume that can be saved depends on several factors; the most important are stand growth rate and amount of weevil injury. Growth rate depends primarily on site quality and stocking. Three site-quality classes can be recognized in New York, either by measuring the previous 5-year height growth on juvenile dominants, by making standard site-index measurements on nearby mature dominants, or by reference to soil characteristics and indicator plants. Stocking may be measured by finding the number of white pines per acre that will probably be dominant or codominant at stand-age 50. A crop-tree stocking estimate of this sort allows experienced estimators to consider the dynamic aspects of stand development, rather than merely current density.

About the same amount of weevil injury currently evident in a white pine plantation can be expected in the future, unless the stand is very young (*3*, *4*). For young stands, future injury rate can be estimated from the rate apparent in older nearby plantations. Current injury rate can be determined by finding the average number of injuries per 16 feet of bole among randomly selected stand individuals.

Taking 70 years as the probable rotation age, the harvest size of protected tree sections can be estimated. Protected-section size, current injury rate, and number of crop trees provide the basis for computing the pine volume that can be saved by weevil control in the various stand classes (*3*).

Protection will increase tree quality as well as merchantable volume because weevil injuries result in defects such as cross grain, large knots, loose knots, red rot, and reaction wood.

An estimate of the amount of lumber degrade from this source, and hence the potential quality savings, was available from studies conducted on the Pack Forest in New York (*5*). The potential quality savings in each stand class were computed on this basis.

Calculating Dollar Value of Savings

White pine is used primarily for lumber, therefore the dollar value of control is the value of the in-

TABLE 1.—ESTIMATE OF VALUE SAVED BY WEEVIL CONTROL[1]
(Dollars per acre)

Stocking[2] (Crop trees per acre)	Weevil injury rate		
	Less than one injury per log	One to three injuries per log	More than three injuries per log
	SITE III		
141 - 275	3	12	23
276 - 415	4	13	26
416 - 550	4	14	28
	SITE II		
111 - 225	4	16	32
226 - 345	5	19	39
346 - 450	6	21	42
	SITE I		
91 - 175	5	17	34
176 - 265	7	25	49
266 - 350	9	31	61

[1]Value estimates represent the midrange values for each stand class. Components of the value estimate were taken at the following levels: age at time of control—10 years; site indexes—45, 60, and 75 feet; average total height at time of control—7, 9, and 11 feet by site class; location of protected 16-foot section—6-22 feet, 8-24 feet and 10-26 feet above a 1-foot stump; number of protected sections per acre—at the midpoint of each stocking range; number of weevil injuries per protected section—0.5, 2.0, and 5.0 respectively; average quality index saving—0.01, 0.04, and 0.11 by injury rate. Date of harvest—60 years hence.

[2]Control not evaluated in poorly stocked plantations.

creased lumber volume and quality from the protected stand, minus additional conversion costs. Dollar savings were calculated by applying projected white pine lumber prices and conversion costs to estimated volume and quality increases for each stand class. These gave estimates of the dollar value of savings, at harvest.

Some of these savings may be lost because of fire, early cutting, and change in land use. To allow for these elements of uncertainty, value of harvest was reduced by 25 percent. This reduced value at harvest was next discounted to the start of the control period at a 3 percent interest rate, giving present worth of the savings anticipated from control in each of the stand classes.

From this information a simple table was prepared showing the average present value of control in the various stand classes (Table 1). To determine the classification of any particular white pine stand it is necessary to estimate only (1) site quality, (2) number of white pine crop trees per acre, and (3) average number of weevil injuries per log. Thus the stand-classification method is practical enough for field use.

Note the range in values saved. Control in well-stocked, seriously weeviled plantations on good sites buys twenty times as much as control in plantations where stocking is low, site is poor, and weevil injury is light. It is important to be able to distinguish among investment opportunities. They vary widely, even among young plantations that may, at first glance, seem much alike. But how about control cost?

Cost of Control

Control cost depends on plantation size, number of treatments, and cost per treatment.

A control site involves an area of white pine made up of one or several contiguous stands. If the stand is not isolated from other forest growth containing white pine, an isolation strip may be required to prevent rapid re-infestation. Isolation-strip width will affect the required frequency of treatment since it governs the rate of re-infestation in the plantation. Width of isolation strip can profitably be increased until its treatment cost equals the cost saving it affords in plantation treatment. Plantation size thus affects optimum isolation strip width as well as control cost.

The number of treatments necessary to maintain injury below the desired level is determined by the rate of weevil re-infestation and the number of years necessary for 16 feet of height growth to occur. The rate of height growth thus sets the length of the control period; the better the site, the fewer the treatments required.

Control costs for the Bureau of Forest Pest Control will not necessarily apply to others. Then too, both techniques and costs change rapidly, and cost estimates must be constantly revised. For these reasons specific cost data are not presented here. But if each of these cost factors is considered, the appropriate control cost estimate can be derived.

Comparing the Opportunities

For each control site the expected return per dollar spent for control may be determined by dividing the value saved by the current estimate of control cost. Potential control sites can then be ranked according to the return anticipated per dollar of control cost. Stands indicating the highest ratios are the best weevil-control opportunities.

For stands where this ratio is less than unity, weevil control would not appear to be a profitable investment. And from the viewpoint of the Bureau of Forest Pest Control, the return/cost ratio potentially available from other pest-control programs would set the lower limit of acceptable return from weevil control.

This delineation of acceptable control sites will provide essential planning information. First, a summation of the values saved on each acceptable site gives the present value of preventable weevil loss—one measure of program importance. Second, a summation of control costs for all such sites indicates the amount of funds that now could be profitably invested in weevil control. And third, the ranking of these sites establishes control priorities and provides a basis for allocating control funds.

Critique

This guide for assessing weevil-control opportunities has several definite limitations. The estimates of value saved do not take into account possible differences in overall management among potential control sites. Management may differ greatly among stands. If harvest is postponed beyond age 70, or if silvicultural treatments increase volume or improve quality, the estimates of value saved may be low. Also, the classification of stands is simple, and therefore relatively gross; there is considerable variation in value saved within individual stand classes.

These limitations arise from the lack of more detailed knowledge about the biological relationships involved, the necessity of developing a practical classification procedure, and the uncertainly which always exists in predicting future events. However, any of the estimates can be revised easily. As better knowledge becomes available from research and field experience it can be introduced into the stand-classification and cost-estimating procedures.

But most important the best available knowledge has been brought together so that the Bureau of Forest Pest Control can intelligently evaluate their weevil-control opportunities. They are planning wisely. Others can do the same.

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Mortality in A Longleaf-Slash Pine Stand Following a Winter Wildfire

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FOLLOWING severe wildfire, it usually is necessary for the forest manager to decide quickly whether or not a salvage operation is needed. To make the best decision, he must be able to predict which trees will live and which will die. The forest manager in the South knows that pines, following wildfires, are frequently attacked by insects, such as bark beetles, wood borers, and ambrosia beetles, often within a few days to several weeks. He knows that salvage cannot be delayed; yet, with his present knowledge, he cannot be sure from external fire damage which trees will eventually die.

An opportunity to add to the inadequate body of knowledge on this subject was afforded the authors following the 110,000-acre Buckhead wildfire of March, 1956. Although the material in this paper is limited to the conditions of the fire, and to longleaf pine (*Pinus palustris* Mill.) and slash pine (*Pinus elliottii* var. *elliottii*), it nevertheless suggests indicators of impending tree death.

Plots were established in one large section of the burn swept by headfire during the fire's major run. A wide range in amount of crown browning, crown consumption, and height of bark charring was represented in the burn for diameters up to approximately 13 inches d.b.h.

An attempt was made to assess and eliminate the effect of bark beetles on mortality by spraying half of the test trees with benzene hexachloride (BHC), a residual, preventive insecticide. The primary aim was to relate ocularly estimated amount and type of damage from fire to mortality when the effect of bark beetles was eliminated. Because beetles had infested some trees before spraying and most trees were not completely covered, this objective was not achieved (Table 1).

Three studies have related tree mortality to external indications of damage from fire. McCulley (*3*), summarizing two studies,[1] [2] states that for slash pine, mortality increases with increasing amount of crown browning for all diameter classes up to 6 inches, when amount of crown browning is expressed as a percent of crown length. For equal crown browning, mortality decreases linearly with increasing diameter. Also, with equal crown browning, mortality was greater when some of the needles were consumed than when none were consumed. McCulley concludes that slash pines with less than 70 percent of the crown browned seldom die if the trees are more than 5 feet tall. Ferguson (*2*), working with loblolly, shortleaf, and longleaf pine, found that these species reacted much the same as slash pine, even in diameters ranging to 15 inches. For loblolly and shortleaf, the depth of basal char and percent of circumference girdled were also important criteria for predicting mortality. The more severe each was, the greater the percent mortality.

Ferguson classified fires according to the season in which they burned, and found that summer fires were more damaging than winter fires. This method of classification can be misleading, especially in the South, because some winter days may be quite warm and some summer days quite cool. It might be better to classify all fires according to the ambient air temperature, because it determines the initial vegetation temperature, which in turn predisposes the buds and cambium to killing by fire (*1*).

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[1] Mann, James M. The influence of fuel, size of tree, and type of fire on the mortality and growth of longleaf and slash pine on the Osceola National Forest. 47 pp. Illus. 1947. Unpublished report U. S. Forest Service, Southeastern Forest Expt. Sta.

[2] McCulley, Robert D. Progress report on a study of the significant factors affecting fire injury and the effect of such injury on the mortality and growth of slash pine on the Osceola National Forest. 27 pp. Illus. 1948. U. S. Forest Service, Southeastern Forest Expt. Sta.

TABLE 1.—MORTALITY BY TREATMENTS

Treatment	Longleaf pine			Slash pine			Both species		
	Sampled	Dead		Sampled	Dead		Sampled	Dead	
	No.	*No.*	*Percent*	*No.*	*No.*	*Percent*	*No.*	*No.*	*Percent*
Sprayed	117	27	23	120	40	33	237	67	28
Unsprayed	118	28	24	120	24	20	238	52	22

In this paper the terms "winter fire" and "summer fire" refer to fires that burned in low or high air temperatures respectively.

The Stand

The stands sampled were predominantly longleaf pine interspersed with ponds and bays made up of slash pine, cypress, and hardwoods. They were well stocked, essentially even-aged, and about 60 years old.

The rough was primarily palmetto with titi and gallberry and ranged in age from 3 to 8 years with a median of 4 years. The rough in most of the bays was much older and very dense. Soil in the bays was highly organic to a depth of several feet and very flammable at the time of the fire.

The Fire

All trees in the study were damaged by headfire the night of Saturday, March 24, and the early morning of Sunday, March 25, 1956, during the major run of the fire. During this period the air temperature was about 45°F., relative humidity about 36 percent, and wind velocity about 18 miles per hour and fairly steady from the N or NNW, measured at the U. S. Weather Bureau's Lake City Station (about 15 miles SW of the fire area). The temperature and humidity had fallen suddenly following the passage of a dry cold front over the area at about 9:30 p.m., Saturday. Temperature and humidity readings at the Lake City Station were 80°F. and 80 percent, respectively, at 2:00 p.m., Saturday afternoon before the front passed. Build-up index was 90 and burning index 55 on the 8-100-0 danger meter at 2:00 p.m. the same afternoon at the Florida Forest Service's Lake City Fire Danger Station.

The Study

The study comprised 475 dominant and codominant trees, 237 sprayed and 238 unsprayed. The trees were chosen from several irregularly shaped blocks approximately 5 acres in size scattered over about 1,500 acres in the burn. Where groups of sprayed and unsprayed trees were adjacent, an isolation strip approximately 2 chains wide was provided between groups to prevent contamination of unsprayed individuals. An attempt was made not to choose all trees of one species, size, or degree of damage from any one block. All trees were selected, measured, and classified within 17 days after the fire was controlled. Spraying was completed 8 days later.

Eight trees of the two species were selected in each of three diameter classes, five crown damage classes, and two treatments. Height of bark charring was recorded for each tree. The three diameter classes were 4 to 6, 7 to 9, and 10 to 12 inches. Two broad classes of readily observable injury were recognized—crown damage and stem damage (Fig. 1). Crown damage, which included all damage to the foliage by both heat (browning of the needles) and flame (consumption of the needles) was expressed as percent of crown length, and was divided into five classes: (1) *heavy consumption*—more than 50 percent of the needles consumed and the rest browned; (2) *medium consumption*—less than 50 percent of the needles consumed and the rest browned. No trees showed noticeable consumption unless all needles were browned; (3) *complete browning*—no green needles visible on the tree (100 percent needle kill); (4) *heavy browning*—green needles visible only at tip of tree and upper branch terminals (91 to 99 percent needle kill); and (5) *medium browning*—green needles present in upper portion of the crown (50 to 90 percent needle kill). Trees with less than 50 percent needle kill were not considered, because earlier investigators found that no trees died from slight injury when air temperatures were low.

Stem damage was classified only by height of bark charring expressed as percent of total tree height. The five heights of bark char classes were: (1) very light (0 to 20 percent char); (2) light (21 to 40 percent char); (3) moderate (41 to 60 percent char); (4) medium (61 to 80 percent char); and (5) heavy (81 to 100 percent char).

It was originally planned to note the type and extent of basal injury for each tree following the method of Ferguson (*2*). This was abandoned because it was soon ap-

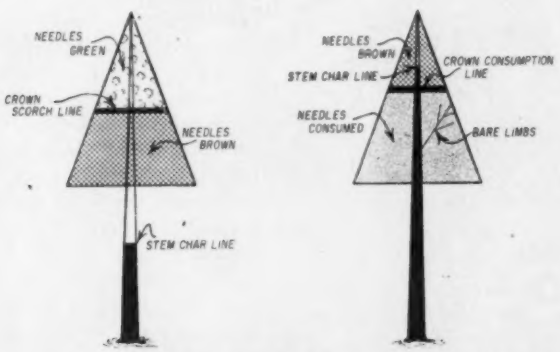

FIG. 1.—Types of crown and stem damage. Note in figure at right that stem char line is higher than crown consumption line. Tree on left would live; trees on right, in all probability, would die.

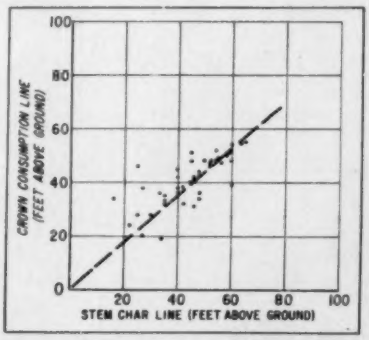

FIG. 2.—Relation of crown consumption to stem char in feet above ground. Longleaf and slash pine are combined. With one exception, each dot represents one tree.

parent that basal bark blackened completely, even at low fire intensity. Even the bark of trees with all needles completely consumed and obviously dead did not appear appreciably blacker or more cracked or dished than trees with only partial needle browning.

The sample trees were examined at 3-, 6-, and 9-month intervals following the fire. All mortality occurred within three months after the fire.

Study Results and Discussion

Size.—In order to compare the relation of mortality to tree size, the species data were divided into three diameter classes (Table 2).

The data indicate that percent mortality decreases with increasing diameter for each species singly and for both species combined. However, non-significant chi square tests indicate that these differences are not statistically significant. This suggests that with equal crown damage, small trees of both species are no more susceptible to fire than larger trees in the 4- to 12-inch diameter range.

Species.—For all diameters combined, or for individual diameter classes, mortality of slash pine versus longleaf pine was not significantly different (Table 2), although the tabular results show slightly greater mortality for slash pine. Results of the statistical tests, which suggest there is no real difference in mortality between the two species, are contrary to results of other workers (*2*). One possible explanation may be that differences in susceptibility between species are not so great as is commonly believed in the middle diameter range covered in the present study. Significant differences might be expected between seedlings or small saplings of the two species. Longleaf pine seedlings, especially when in the grass stage, have been shown to be much more resistant to fire than slash pine seedlings.

Because all trees were dominants or codominants, it was not possible to compare mortality as influenced by canopy position.

Crown Damage.—There was no mortality in any of the three crown browning classes, even though needle kill ranged from 50 to 100 percent (Table 3).

However, about 42 percent of the trees of both species died that had from 1 to 50 percent of the needles consumed and about 87 percent died when more than 50 percent of the needles were consumed. Mortality of slash pine was not significantly greater than longleaf pine.

Probably the lack of mortality in either species from crown browning alone is attributable to the low air temperature (45°F.) in which the fire burned. Had the ambient air temperature during the fire been greater, probably some mortality of both species would have resulted from crown browning alone. Ferguson (*2*) noted substantial mortality among shortleaf and loblolly pine from summer fires even when more than half the needles were still green.

Byram (*1*) has pointed out that a headfire of given intensity and burning in the winter when the air temperature is low will cause considerably less mortality than a fire of the same intensity burning in the summer when the air temperature is high. This is because the lethal temperatures of the vital tree parts, the buds and cambium, generally are not reached or exceeded in the winter fire due to their lower initial temperatures. It is the killing of buds and cambium, not the needles, that causes a fire-damaged tree to die.

It seems reasonable that in wildfires the amount of crown consump-

TABLE 2.—MORTALITY BY DIAMETER CLASSES

D.b.h. class (inches)	Longleaf pine			Slash pine			Both species		
	Sampled	Dead		Sampled	Dead		Sampled	Dead	
	No.	*No.*	*Percent*	*No.*	*No.*	*Percent*	*No.*	*No.*	*Percent*
4-6	79	22	28	80	25	31	159	47	30
7-9	79	17	22	80	22	28	159	39	24
10-12	77	16	21	80	17	17	157	33	21
All	235	55	23	240	64	27	475	119	25

TABLE 3.—MORTALITY BY CROWN DAMAGE CLASSES

Crown damage class	Longleaf pine			Slash pine			Both species		
	Sampled	Dead		Sampled	Dead		Sampled	Dead	
	No.	*No.*	*Percent*	*No.*	*No.*	*Percent*	*No.*	*No.*	*Percent*
Heavy consumption (>50%)	43	36	84	48	43	90	91	79	87
Medium consumption (1-50%)	48	19	40	48	21	44	96	40	42
Complete browning (100%)	48	0	0	48	0	0	96	0	0
Heavy browning (91-99%)	48	0	0	48	0	0	96	0	0
Medium browning (50-90%)	48	0	0	48	0	0	96	0	0
All	235	55	23	240	64	27	475	119	25

TABLE 4.—MORTALITY BY STEM DAMAGE CLASSES

Stem damage class (percent of char)	Longleaf pine			Slash pine			Both species		
	Sampled	Dead		Sampled	Dead		Sampled	Dead	
	No.	*No.*	*Percent*	*No.*	*No.*	*Percent*	*No.*	*No.*	*Percent*
Heavy (18-100)	49	43	88	64	56	88	113	99	88
Medium (61-80)	19	10	53	17	4	24	36	14	39
Moderate (41-60)	22	2	9	31	4	13	53	6	11
Light (21-40)	107	0	0	81	0	0	188	0	0
Very light (0-20)	40	0	0	45	0	0	85	0	0
All	237	55	23	238	64	27	475	119	25

tion is related to the amount of needle browning and both are related to injury of buds and cambium because all three manifestations of damage are the result of the temperature rise caused by the fire. Strictly speaking, this relationship holds only when all trees are burned by similar fires in the same ambient air temperature. The needle browning line should always be considerably higher in the crown than the crown consumption line because the lethal temperature for pine needles is about 140° F. (*1, 4*), whereas a temperature above 350°F. is necessary to consume needles and small twigs. In fact, only a very tall tree with a very long crown could have both green needles at the top and crown consumption at the base of the crown. In the present study, crowns were generally short and no trees suffered crown consumption unless all needles were completely browned.

The fact that the southern pines generally have rather short crowns may limit the usefulness of crown damage as an indicator of mortality after summer fires. At the temperature just sufficient to brown the needles on the leader, the needles at the base of crown might be far below their temperatures for consumption. A considerable increase in temperature would be necessary for incipient consumption. This temperature rise would no doubt cause increased mortality of buds and cambium and thereby increase the probability of tree mortality. However, neither of the two parts of the crown damage criterion would reflect this increased probability of mortality. Stated another way, the crown damage criterion of potential mortality breaks down at the point where it is necessary to shift from crown browning to crown consumption. The above would not apply for winter fires, since no mortality would ordinarily be expected unless a portion of the crown were consumed.

The duration of temperature also affects mortality of pine needles, as shown by Nelson (*4*) and Byram (*1*). However, duration of temperature is probably not important in this study, since as nearly as could be determined, the same type of fire burned all trees and wind velocity was fairly constant.

Height of crown consumption and height of bark char, both measured in feet above ground, also are related. This relation for a group of trees from the study is shown by Figure 2. The freehand-fitted regression line shows that the stem char line generally is above the crown consumption line and the ratio between the two is approximately constant for any amount of crown consumption or stem char. This sort of relation would be expected because a higher temperature is required to consume green pine needles than to char dry pine bark. The ratio height of char to height of consumption should remain constant regardless of ambient air temperature. Heights of crown consumption were determined by adding midpoints of crown consumption classes to measured heights of the base of crown.

Stem damage.—Charring of stems over 80 percent of their lengths caused significantly greater mortality than did the two lesser stem char classes in which mortality occurred (Table 4). There was no mortality when less than 41 percent of the stem was charred.

This study indicates that bark char may be a more useful indicator of mortality than crown damage because: the line of incipient char is readily discernible on the stem; it is independent of tree size and crown length when expressed as a ratio to total tree height; and unlike the crown damage criterion, which involves shifting from needle browning to crown consumption, it is a continuous criterion of tree mortality.

Weather.—Another factor affecting mortality of fire-damaged trees is the weather before and after the fire. Rainfall excess or deficiency is probably the most critical weather element. Temperature may also be important because it affects the rate of water loss from the soil through evapotranspiration.

Drought conditions in north Florida had been building up since January 1954. For one year prior to the fire, the cumulative deficiency of rainfall was 17.39 inches (Fig. 3) but from the inception of the drought, the deficiency totalled 37.51 inches.

During the first 3 months following the fire, by which time all mortality had occurred, there was an excess precipitation of 4.63

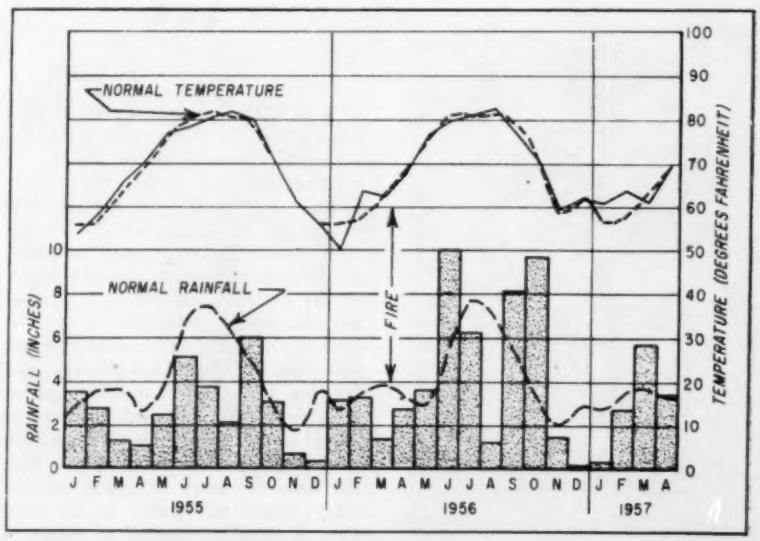

FIG. 3.—Rainfall and temperature distribution and normals for one year preceding and following the Buckhead fire of March 25, 1956. U. S. Weather Bureau, Lake City, Fla.

inches. The excess for the 12 months following the fire amounted to 1.82 inches but the ground water table still was low. Thus, it appeared that the drought was slacking off, but was still critical since there was a two-year deficiency of 35.69 inches. Temperatures averaged slightly below normal the first 3 months following the fire, but slightly above normal over the first year following the fire.

Judging from the records, rainfall and temperature conditions the first 3 months after the fire would seem to favor survival of fire-damaged trees. However, rainfall and temperatures averaged about normal over the first year following the fire and the severe drought over the 2 years preceding the fire may have reduced the vigor of the trees, making them more susceptible to fire and insect kill. At present there is no accurate quantitative method for evaluating the effect of antecedent and subsequent weather conditions on mortality.

Summary and Conclusions

Results from this study show that the chances of longleaf and slash pine mortality from damage by winter headfires can be estimated by the amount of crown consumed. Approximately equal proportions of large and small trees of both species died from equal amount of crown consumption.

Nearly 9 trees in 10 died when more than half their needles were consumed by flame and 4 trees in 10 succumbed when less than half their crowns were consumed. Even 100 percent needle browning caused no mortality. Presumably this was because initial temperatures of the buds and cambium were low and were not raised to their lethal temperatures by the fire.

Height of bark char on the stem in percent of tree height also was related to mortality. Approximately 9 trees in 10 died when 80 percent or more of the stem was charred and 4 trees in 10 died when 60 to 80 percent of the stem was blackened. Mortality was very slight where stems were charred less than 60 percent of their lengths. Bark char has several advantages over crown damage as an indicator of mortality.

Above-normal rainfall and below-normal temperature conditions the first 3 months following the fire were favorable for survival of fire-damaged trees. However, the general drought condition in the area before the fire persisted for another year.

The mortality indicators developed in this study are limited in application to other situations having similar air temperature (45° F.), fire (headfire), beetle (light attack), and antecedent weather (fairly normal) conditions. Air temperature was probably the most significant weather factor in reducing mortality. It is quite possible that mortality would have been double or triple had the Buckhead fire burned in an air temperature of 90° F.

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"One of the most striking conclusions about the Forest Service is the degree of similarity among the men in it—their love of outdoor life; their pride in the Forest Service; their habit of taking the long view of things; their patience; their acknowledgment of their obligations to the local users of the national forests; their acceptance of the inevitability of conflict growing out of differences among the many users of the national forests, and between the national interest as against local or special interest; their enjoyment of the variety in Ranger district administration as compared with the narrower scope of industrial forestry; their willingness to do more than is legally required of them in order to get their jobs done."—From *The Forest Ranger* by Herbert Kaufman (Johns Hopkins Press).

The Australian Mistletoe

D. Hartigan

MISTLETOE is common on Australian trees, particularly eucalypts. It appears as a clump of pendulous foliage closely resembling the natural foliage of the eucalypt, but usually slightly more yellowish. Actually, the color varies with the season, being almost brown in winter and in spring and summer closely approximating the characteristic glaucous hue of the eucalypt. This habit has often led observers to believe that the mistletoe in their district is dying, only to find that it apparently recovers a few months later.

The mistletoe is a parasitic plant —more precisely it is a hemi-parasite—because it manufactures some of its own food through the ordinary photosynthetic mechanism employed by all green leaved plants. There is, however, no root system in the strict sense but instead a structure known as an haustorium or colloquially a "sinker." This structure anchors the parasite to the host tree and enables it to withdraw sap for its own requirements.

As a consequence of the withdrawal of sap the branch beyond the point where the mistletoe is attached becomes withered and quickly dies and breaks off. The result is that mistletoes thus appear to be attached to the ends of branches. Each clump of mistletoe is a separate plant for the great majority of species.

The aggressive character of the pest and the efficiency of its reproduction can be estimated from counting the number of plants on a badly infested tree. Two hundred or more mistletoes are common on a large eucalypt and in such cases practically all the natural foliage of the tree has been supplanted by the parasite.

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Mistletoe occurs in patches, particularly edging open spaces and along roadways. Trees standing in cleared paddocks around homesteads or close to stockyards are often heavily infested, as are trees in managed pastures or catchment areas. It is this pattern of attack where trees are minimal that makes mistletoe damage of such importance.

The reason for such a curious preference of host trees can almost certainly be ascribed to birds since these seem to be the main distributors of mistletoe seed. It is normal for birds when disturbed to make short flights to trees bordering any clearing rather than penetrate deeply into a wooded area. Beak and claws are cleaned of attached mistletoe seeds or voiding takes place before the bird moves on. In this way fringe trees along roadways become heavily infested. Furthermore, mistletoe is a light loving plant and does better in sparsely wooded areas.

Once a few trees have become infested, the spread of the parasite occurs radially and it is not long before many trees in the locality are affected.

Good seasons appear to assist the mistletoe, but whether this is a side effect following from the greater number of birds or whether it is due to more viable seed following vigorous growth is not known.

Mistletoe is a pest of importance in Australia (*1*) and from observations that have been made by reliable observers, appears to be increasing. (Figs. 1, 2, and 3.)

Host Range

Australia has a goodly proportion of the world's mistletoes with 13 genera (2 terrestrial) and 58-60 species out of a total of approximately 60 genera and 600-700 species. Most of these genera are found in tropical and sub-tropical areas such as Africa, India, America, Burma and so on. The European mistletoe is not widespread and the American genera Phorodendron and Arceuthodium are found on

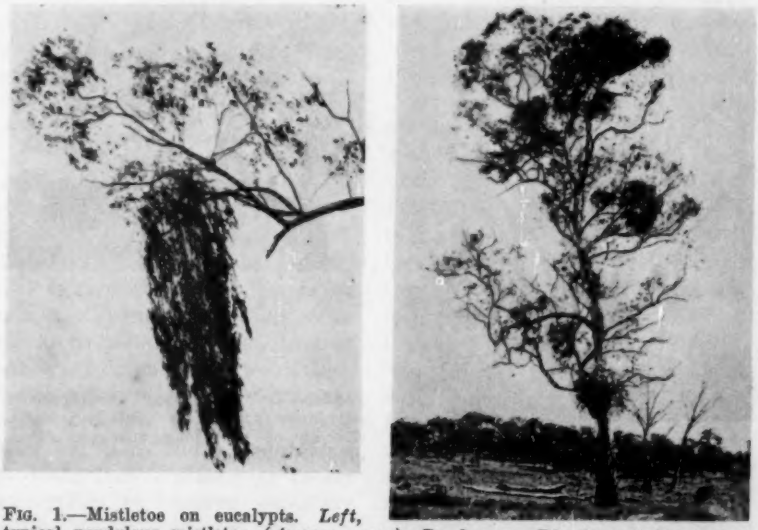

FIG. 1.—Mistletoe on eucalypts. *Left*, typical pendulous mistletoe (*Amyema* spp.), Bendermeer District; *right*, typical heavy infestation with mistletoe, Orange District.

conifers almost exclusively (*8, 9*).

In the eastern states of Australia, while it may not be true to say that all trees are susceptible to mistletoe, close investigation shows that a great many trees hitherto held to be practically immune are in fact freely parasitised. The native Callitris and kurrajong, for example, are becoming increasingly affected whereas May (*10*) in her survey (1941) mentions them as comparatively free from attack. Of course, it may well be that only one species of mistletoe is involved and has become disseminated by increased transport and good seasons.

Many other western species such as wilga, warrior bush, and budda are also liable to become infested. Probably some confusion has arisen because the mistletoes on some of these western trees do not resemble the characteristic plants on the eastern eucalypts.

On wilga, for example, the mistletoe commonly found is *Korthalsella opuntia* (Thumb.) Merrill, and is an insignificant plant with very small flowers and a stoloniferous or creeping habit. It often spreads around the tree beneath the bark and thrusts haustorial cushions into the sap at intervals and appears to be "strangling the tree" somewhat in the manner of a climbing fig.

On the trees of the coastal rain forests mistletoe can also be found, but once again the appearance is different and the type commonly met is an upright, thick, glossy-leaved specimen with a heavy appressed haustorium. Mistletoe is not very common in dense forests and, because it is usually attached high up in the branches of tall scrub trees, is not often noticed even when present. Because of these circumstances, it is often affirmed that such trees are not parasitised by mistletoe.

Among the Myrtaceae (eucalypts, angophoras, etc.) parasitism is general. It has often been claimed that particular species are resistant in one locality or another. For example, rough barked eucalypts may appear to be attacked in one area while smooth-barks nearby are free of attack. In another area the position may be reversed. These preferential attacks appear to be species relations in most cases but there is also the possibility that local variations in vigor of trees may account for some of the cases noticed. Shelving of bark at the critical stage when the young mistletoe embryo is putting out its haustorium or even actual thickness of host bark are obvious weaknesses in the junction of parasite to host.

Experience to date has not justified any assumption that host resistance exists to any worthwhile degree—at least among eucalypts.

Casuarinas are attacked to a considerable degree although probably not as much as eucalypts, while fruit trees although liable to infestation are seldom seriously parasitised in the cultivated state, probably because of pruning. Ornamental exotic trees are usually protected in the same manner as fruit trees. Pines have formed no general relations with local mistletoe (although cases are reported by Blakely) (*2*) and the common northern American mistletoes have not yet appeared in this country.

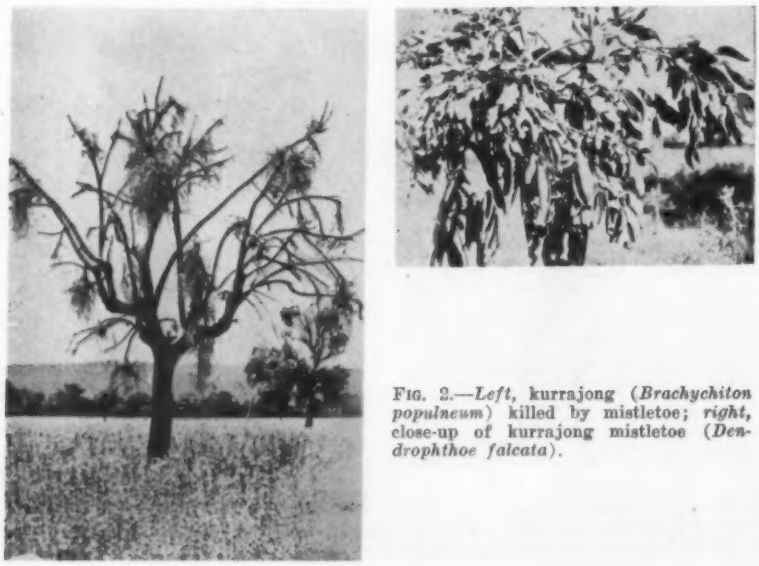

FIG. 2.—*Left*, kurrajong (*Brachychiton populneum*) killed by mistletoe; *right*, close-up of kurrajong mistletoe (*Dendrophthoe falcata*).

Damage Done to Trees by Mistletoe

The prima facie evidence for loss of vigor or reduction in growth of trees infested by mistletoe in Australia is considerable. It is commonplace to see heavily parasitised trees which are dead, and the feature mentioned above whereby mistletoes obviously interfere with the sap flow of healthy branches is easily seen. It is difficult to conceive that a tree is thriving when two-thirds or more of visible foliage belongs to the parasite. Nicholson (*12*) has endeavored to express this loss of vigor and increment quantitatively and has shown from his experiments that the percentage of crown supplanted by mistletoe bears a direct linear relation to the reduction of basal area increment in *Eucalyptus polyanthemos*. On the other hand, it is true also that mistletoe takes many years under normal conditions to kill a eucalypt, and it is this very slowness which is responsible for the rather complacent attitude adopted by Australians toward mistletoe damage. This attitude is changing.

Biological Factors Affecting Growth of Mistletoe

Mistletoe will parasitise mistletoe and some interesting cases of this phenomenon have been described. However such parasitism has the aspect of being accidental rather than a genetic event, and certainly has very little effect on

control of mistletoe naturally.

Insects and fungi do not seriously inconvenience Australian mistletoes. Actually, the larvae of quite a number of butterflies and moths feed on mistletoes but the damage they do seems to be mostly superficial. In addition, some beetles and scale insects cause a modicum of damage either by burrowing in the stem (usually of old plants) or feeding on the leaves, but to date, nothing which gives any promise of biological (insect) control has appeared.

Among the fungi, Blakely (*2*) mentions some leaf spotting organisms but again there seems little promise of natural control along these lines. It would, of course, be interesting to know if predators affect mistletoe in other parts of the world, particularly in subtropical areas, but nothing appears to have been published on the subject. For the present, therefore, biological control of mistletoe does not seem likely.

Although it is generally conceded that mistletoe is a light loving plant it is not quite clear what this implies. Certainly it needs light to carry on the photosynthesis which is common to all green leaved plants but mistletoe is found in shady locations such as brush forests and it appears to have species adapted to such conditions. Tests conducted by May (*10*) on *Loranthus miquelii* indicate that light doubled the germination rate. However, as she observes, "absolute darkness" would not be experienced even in the thickest forests. Blakely (*2*), too, states that the hypocotyl of the developing embryo is negatively phototropic.

On trees there does not seem to be any preferred location as might be indicated by a greater number of mistletoe on the northern exposure in southern parts of the continent nor does the leaf habit indicate very much.

It is a fact that much Australian plant life is exposed to an intense "hard" light over many months of the year which exerts some screening effect with some species, but the mistletoe seems to have adapted itself to a wide range of circumstances all over the world.

FIG. 3.—Mistletoe in flower on Casuarina. Note withered branch beyond point of attachment of haustorium. Mistletoe is a coastal species, *Amyema congener*.

Other climatic factors which include drought and flood seasons seem to be important to the mistletoe more from the effect they have on the normal seed vectors than of themselves. It has, for example, not been observed in drought seasons that mistletoe does any worse than the plant it parasitises. In fact, as would be expected, the reverse seems true, namely that the struggle for life by a heavily infested tree becomes intensified during a drought.

Fire, although it cannot be regarded as a climatic factor, has clearly had a profound ecological influence on the Australian landscape. Fire has also very likely had some controlling influence on mistletoe spread in the past. This would be because, unlike the host eucalypt, the mistletoe would lack the advantage of protected dormant buds to reclothe itself with foliage after burning. There is also some evidence that mistletoe is rather susceptible to burning on other counts too, perhaps by reason of thinner bark or some such factor.

The foliage of mistletoe often seems to match the foliage of the species it grows on. It is further maintained that such matching must have some survival value to the mistletoes. Blakely makes a strong case against this assumption pointing out that its very distribution depends upon its being conspicuous to birds and animals, hence the bright colors of the flowers and berries. He also gives an example of leaf form on an exotic species which so closely resembles the eucalypt that it was given that specific title, and yet such an association was not possible in Venezuela, its country of origin.

But mistletoe foliage often does resemble that of the host tree. On Casuarina, for example, the mistletoe most commonly discovered in the western part of the state of New South Wales has a long thin needle-shaped leaf, much like that of the Casuarina. On scrub trees the leaf is often flat and ovoid like the host trees. On Callitris there is a spikey needle-like leaf form rather like the Callitris and of course on eucalypts the foliages of plant and parasite are often very similar in appearance. Other examples could be quoted. On the other hand there are many examples to be seen where the mistletoe present does not conform to the host foliage. Probably all that is signified is that ecological factors acting over a long period of time have conditioned the mistletoe in the same manner as they have the host plants.

More has been written locally about the methods of dispersal of mistletoe seed than about any other phase of the activities of the pest. Presumably, the motive behind this research is that if you can "scotch" the principal distributor of seed then you can automatically control mistletoe. Unfortunately, for this theory there does not seem to be any principal offender.

The so-called mistletoe bird *Dicaeum hirundinaceum* (Shaw) was once thought to be the sole agent of dispersal but it is now realized that it is only one of many birds which feed on and therefore presumably help to disperse mistle-

toe. A list of bird disseminators has been given by Blakely and undoubtedly this list can be added to as mistletoe becomes more prevalent. It is quite possible that newcomers to this continent such as the Mitre bird or Bulbul are also involved.

Apart from birds, animals such as flying foxes and sugar squirrels have been named as likely distributors. There has been lively controversy as to whether a natural decrease of opossums and koalas has led to an increase in mistletoe, because such animals might have chewed and destroyed mistletoe seed. These arguments seem scarcely to have justified the time spent on them.

It seems probable that birds disperse mistletoe seed on their beaks after feeding on the fleshy fruit more than by the action of swallowing the seed and voiding it. It has been commonly observed that birds have some difficulty in dislodging the sticky seeds from their beaks and claws and much scraping and preening ensues. This is conducive to wide dispersal.

The extremely sticky material known as viscin which surrounds the seed in a membraneous sac is a very effective adhesive. It is only necessary to brush past a mistletoe plant with mature seeds to pick up a large number of seeds. Later the viscin dries out and hardens and forms a firm base for leverage of the developing radicle which is to penetrate the bark of the host.

Life Cycle of Australian Mistletoe

Both the age of mistletoes and time taken to spread have been the subject of debate and as with the question of dispersal it is difficult to be specific, lacking experimental evidence. Based on a number of observations, the average life of the mistletoe plant appears to be about 10 years, although this estimate must be hedged with provisos relating to weather, insect damage and so on. Such an estimate seems to agree with American experience with different genera and different host trees.

Spread of mistletoe is even more dependent on environment than is life-span but again observations made on selected areas over a period of approximately 10 years seem to show that a single well-developed mistletoe will act as a focus for infesting the neighboring area in a radial manner; that a plant develops from the 2-4 leafed stage to a well foliaged plant approximately 3 feet in diameter in about three years; and that such a plant will reproduce itself about five times in a season. These statements are not speculative but lack a statistical backing. They refer mainly to the outlying areas around Sydney, New South Wales.

The life cycle of the mistletoe is that of the ordinary flowering plant except that it grows attached to a woody plant instead of in the soil (exceptions are the terrestrial genera). Mistletoe is an evergreen although it loses a lot of its foliage in winter months. In spring (September-November) it puts out fresh leaves and flower buds, and mature fruit is available in the Sydney area from December to March. Mistletoe follows the normal seasonal changes, maturity being earlier in the north of the continent and delayed on the highlands.

The species within the various genera are extremely flexible in the broad sense so that the parasite can accommodate a wide range of circumstances. This makes for efficient parasitism.

The critical stage of the life cycle is the attachment to the host and this has been described in considerable detail by McLuckie (*11*) in respect to *Notothixos incanus* (Oliv.) var. *subaureus*. Assuming that a seed has fallen onto a favorable location where it is anchored by viscin, a tiny radicle appears in response to moist condition, and growth proceeds drawing on the stored starch of the seed endosperm. The root is not geotropic as with most plants but it is negatively phototropic with the result that it grows toward the more shaded parts of the branch. The root often takes a complete turn to set itself at right angles to the bark and in this position forms a flattened end.

Apparently pressure and enzymatic softening occur as indicated by the crushed and discolored cells of the host tissue. The root grows through the bark and into the cortical tissue where rapid cell differentiation occurs and a vascular system is laid down. The interesting juxtaposition of the elements of food and water conservation in the host and those responsible for a like function in the parasite throw a good deal of light on the essential physiology of the mistletoe.

McLuckie infers from his observations on the species he studied that it was essentially a water parasite and did not draw on the host for synthesized food. This may or may not apply to other mistletoes. Almost certainly, as McLuckie observes, it does not apply to Arceuthobium, which is deeply imbedded in host plant tissue without external parts for many months of the year.

Having established a root in the host plant, the mistletoe branches and develops leaves to carry on its own photosynthesis and thereafter functions as a separate plant. Blakely considers most Australian mistletoes to be self-pollinated although hybridization is possible.

Control of Mistletoe

Eradication of mistletoe is virtually an impossible task without a biological agent and so far there has been no promise that such an agent exists—at least in this country. There is left therefore only the possibility of exerting a controlling influence on the spread of mistletoe. Efforts which have been made in this direction are as follows:

Lopping. — Although such a method seems crude, nevertheless it is clear that mistletoe infestation is a slow process and it is also cumulative. Every mistletoe destroyed therefore is a source of infestation removed. With large populations rapidly increasing, it is necessary to destroy quickly to make headway against the pest, for example, with locust plagues. Mis-

tletoe, however, does not come within this category and it is perfectly feasible to free an area for a considerable number of years providing the work is carefully done.

In orchards and gardens and for selected trees around homesteads, schools, and so on, lopping is probably quite satisfactory. Against lopping as a control measure there is the expense and tedious nature of the operation. With large trees covered in mistletoes, the task becomes very difficult.

Certain mistletoes produce adventitious roots which must be traced under the bark to insure complete eradication. Some trees will stand only limited lopping and too heavy pruning of branches will kill them.

Spraying with chemicals. — In 1948 experiments were conducted near Sydney with 2,4-D as a spray against mistletoe (*6, 7*). At that time the "hormone" weedicides were only beginning to find their way to Australia from U.S.A. and England and the choice of formulations was not very great. It was discovered that mistletoe reacted much more intensely to 2.4-D than did eucalypts. This fact suggested the possibility of using a spray to control the mistletoe without at the same time damaging the host.

After a considerable number of trials, the following facts emerged:

1. An 0.5 percent solution of the sodium salt or the amine salt of the 2,4-D is an effective spray against mistletoe on eucalypts.

2. An overall spray of tree foliage and mistletoe could be used but it was more economical to spray the mistletoe alone.

3. The spray was most effective when applied after the first spring flush of host and mistletoe. It was also more effective when applied after a shower of rain. This is probably a correlated effect.

4. "Stickers" and hygroscopic adjuvants such as glycerine pitch were of advantage with the straight sodium salt of 2,4-D but did not seem to add to the effect with the formulated amine salts. (These already contain proprietary wetting agents).

5. Neither the esters of 2,4-D nor 2,4,5-T compounds were as effective as the salts of 2,4-D already mentioned.

6. Trees other than the Myrtaceae (eucalypts, angophoras, tristanias, etc.) are adversely affected by 2,4-D at the concentration used. Certain trees like acacias, kurrajongs, and casuarinas are severely defoliated. The spray method therefore is confined to eucalypts and close relatives.

Within the limitations indicated the spray method of controlling mistletoe represents an advance on lopping. Mistletoe is usually attached to the lower third of the crown of the tree and also on trees which are isolated or in surroundings more or less accessible for spraying.

Injection with chemicals.— This approach was initiated in Australia by the Division of Plant Industry, C.S.I.R.O. at Canberra (*3, 5*). First results were not promising because many of the chemicals used were too toxic to the trees. However, it was discovered that copper sulphate at low concentration did affect mistletoe more than the trees. In 1951 2,4-D used as a 10 percent amine salt in water solution was shown to be an effective systemic poison against mistletoe.

The advantages of such a method over the spray technique are that it is more thrifty with chemicals, can be carried out by an individual without expensive equipment, and overcomes the major drawback of the spray in that it enables tall trees to be dealt with at ground level.

On the other hand the time lag between treatment and results is very long—up to 18 months in some cases; it is not easy to bore holes into some hardwoods; and results can be very variable. Undoubtedly, the method is promising and it should be possible to overcome some of the deficiencies mentioned. Current research is aimed at such correction (*4*).

Silvicultural treatments in forests.—Most of this work has been done in the southwestern states of America on conifers and with mistletoes not met in Australia. The Australian pest is so widespread in the natural (Eucalyptus) forests that the silvicultural approach has not been considered except on a limited scale.

Value of mistletoe as stock feed. —There have been many reports that mistletoe is particularly palatable to stock, even when green pasture is available. The author has seen no outstanding cases of such preference. There seems to be little doubt that sheep and cattle will eat mistletoe—at least the common varieties—and suffer no ill-effects from such intake. On the other hand, there are no advantages that can be compared with the possession of, say, the fodder trees such as wilga, and kurrajong in a grazing property and these mistletoe will destroy.

Is control practicable?—This is, of course, the fundamental question after considering the mistletoe infestation problem on Australian trees. Hormone spray and injection methods taken in conjunction show that control is possible at a price. So far as managed hardwood forests are concerned, mistletoe has not so far proved a very serious threat, and exotic Pinus species are not infested at all.

Summary

It would seem that mistletoe can be dealt with as a limited pest on grazing properties, catchment areas, roadways, and parklands.

The price of control in such places should not be excessive particularly if the injection process can be brought to a higher degree of efficiency.

It is true, of course, that events may alter this viewpoint such as for example more rapid spread of infestation due to newly acquired habits of vectors, introduced birds, or introduction of mistletoe capable of infesting Pinus plantations.

Very obviously, the ecological balance of parasite to host has changed over the last 50-100 years and is probably still changing.

In view of this situation, there is no final word that can be written and the question of tree health and

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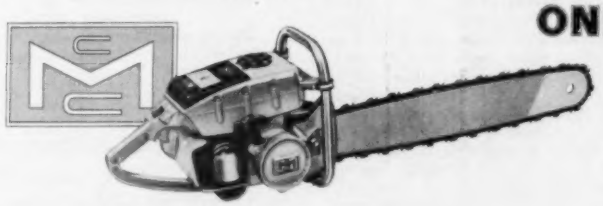

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mistletoe infestation must be reviewed from decade to decade.

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Division of Silviculture
Call for Annual Meeting Papers

The 1960 annual meeting of the Division of Silviculture will be held on Tuesday, November 15, in Washington, D. C. There will be morning and afternoon sessions.

Correspondence relating to the Division of Silviculture should be addressed to Dr. J. H. Buell, chairman, Yale School of Forestry, 205 Prospect St., New Haven 11, Conn. Society members who wish to present papers should submit, in triplicate, the following information: (1) title; (2) short abstract; (3) name and address of the author; (4) name and address of the organization represented; (5) time required for presentation; and (6) type of projection equipment required. This information must be received prior to May 15, 1960 to be considered.

The program will be made up by the executive committee of the Division by selection of papers from the proposals received. Papers that can be presented in 15 minutes or less are favored, and none will be considered which require more than 20 minutes.

Authors of papers that are selected will be notified by June 15.

This is the only call for papers that will be issued by the Division of Silviculture.

FRANK W. WOODS
Secretary,
School of Forestry,
Duke University, Durham, N. C.

Notes and Observations

Fifth World Forestry Congress

Provisional Program

Opening Plenary Session: August 29, 1960.
Closing Plenary Session: September 10, 1960.
General and Technical Sessions: August 30-September 9.

First General Session

Multiple Use of Forest Lands

Keynote Address:

The Concept of Multiple Use of Forest and Associated Lands—Its Values and Limitations.
R. E. McArdle—U.S.A.

1. Application and opportunities for multiple-use forestry on a geographic basis.

Second General Session

Multiple Use of Forest Lands

2. Application and opportunities for multiple-use forestry on an ownership basis.

Third General Session

Progress in World Forestry

Keynote Address:

Role of Forestry in World Economic Development.
Egon Glesinger—FAO, Rome

1. Forestry progress in Western Europe and the Mediterranean.
2. Forestry progress in the U.S.S.R. and in Eastern Europe.
3. Forestry progress in the Near East.
4. Forestry progress in Africa.
5. Forestry progress in the Far East.
6. Forestry progress in Latin America.
7. Forestry progress in North America.

SECTION I. SILVICULTURE AND MANAGEMENT

Session A

Inventories of Forest Resources

1. Selecting objectives and standards for estimating forest resources.
2. Surveys particularly applicable to extensive forest areas.

Session B

1. Advances in forest survey design and procedure.
2. Aerial photogrammetry in forest surveys.

Session C

Semi-Arid and Arid Land Forestry

1. Progress in the integration of forestry and grazing.
2. Advances in reforestation and afforestation practices.

Session D

Modern Concepts and Advances in Silviculture and Management

1. "Orchard" versus "Naturalistic" silviculture.
2. Relation between forest production and growing stock.

Session E

1. Planning and control of the managed forest, including new inventory control procedure.
2. The influence on silviculture on delivered prices of primary forest products.
3. New methods of improving stand composition.

Session F

Forest Ecology and Soils

1. Classification, mapping and interpretation of soils for forestry purposes.
2. Intensive soil management for increased forest production.
3. Relation of forest diseases to soils and soil management.

Session G

1. Evaluation of forest site quality from soil, topographic and climatic factors.
2. The nutrient cycle and its modification through silvicultural practice.

SECTION II. GENETICS AND TREE IMPROVEMENT

Session A

Progress in Tree Improvement and Proposals for International Cooperation

1. Progress in forest genetics and tree improvement.
2. Proposals to facilitate the exchange of breeding material.
3. Problems and proposals for international forest tree seed certification.
4. Problems and proposals for international certification of seed origin and seed-stand quality with particular reference to the species native to Western North America.

Session B

1. Delineation of improvement objectives and their possible attainment:
   a. Growth and stem form
   b. Pest resistance (diseases, insects and other agents)
2. The role of cytology, physiology and exotics in tree improvement:
   a. The role of cytology in forest genetics research
   b. The role of physiology in forest tree improvement
3. The role of exotic species in forest tree improvement.

Session C

1. Improvement through the utilization of natural variation:
   a. Improvement through racial selection and testing
   b. Improvement through individual tree selection and testing, seed stands, and clonal seed orchards
2. Improvement through the creation of new types:
   a. Improvement through inbreeding and intraspecific and interspecific hybridization
   b. Mass production of control-pollinated seed of conifers
   c. Improvement through polyploidy and mutagenesis

SECTION III. FOREST PROTECTION

Session A

Forest Pathology

1. Intercontinental spread of forest pathogens. Significance of introduced diseases.
2. New approaches to forest disease control:
   a. Chemical control, including antibiotics
   b. Cultural control
   c. Present and potential significance of root rots in intensive forest management

Session B

Forest Entomology

1. Chemical control of forest insects:
   a. Aerial spraying, including side effects.
   b. New approaches, including systemics
2. Biological control of forest insects:
   a. The role of parasites and predators
   b. New approaches
3. Cultural control of forest insects.

Session C

Forest Fire

1. Forest fire control methods and practices:
   a. Mechanization of forest fire fighting
   b. Meeting protection objectives in difficult years
   c. Aerial support of ground fire fighters
2. Forest fire research:
   a. Research in principles governing fire spread
   b. Research in forest fire control

Session D

Weather and Climate in Forest Protection

1. Climate and disease epidemics.
2. Weather and insect epidemics.
3. Weather and fire control practices.
4. Lightning-caused forest fires.

SECTION IV. FOREST ECONOMICS AND POLICY

Session A

Policy and Economic Problems in the Conversion of Old-Growth Forests to Managed Stands

1. Africa.
2. South America.
3. North America.
4. Asia.

Session B

Supply, Demand and Marketing of Forest Products

1. Role of timber supply and requirements analysis in formulating forest policy.
2. Development of markets for forest products: needs and techniques.
3. Effect of population pressures on timber needs.
4. Potentialities of tropical forests in the world's timber economy.

Session C

Institutional Arrangements for Forestry

1. Relation of public agencies to private forestry.
2. Opportunities for foreign investment in forestry.
3. Cooperatives for forest management and marketing of timber products.

Session D

How to Achieve Better Management on Small Woodlands

1. Special problems of the small forest owner.
2. Means of promoting forestry on small woodlots.

SECTION V. EDUCATION

General Theme: Education in Forestry for Countries with Newly Developed Forestry Programs.

Session A

Criteria for Determining Types, Size and Scope of Programs

1. Estimating the need for forestry staff at various levels.
2. Criteria for deciding whether to develop a full program, technician to post-graduate level.
3. Fixed versus free programs.

Session B

Developing Technical Educational Programs

1. The ranger school.
2. The professional school.
3. Post-graduate education for world forestry.

Session C

Developing Public Awareness of Need for Forestry

1. Public educational programs in nations having limited experience in forestry.
2. Education for political and industrial leaders.
3. Education for farmers and other small woodland owners.
4. Forestry education and programs in a nation with a rapidly changing forest economy.
5. Forestry extension and public education in a nation having a well-developed forestry economy.

SECTION VI. FOREST PRODUTS

Session A

Wood: Its Structure and Physical and Mechanical Properties

1. Recent progress in research on wood cell wall structure.
2. Structure of wood as revealed by the electron microscope.
3. Influence of microscopic and submicroscopic structure on the anisotropic characteristics and properties of wood.
4. Rheology of wood.
5. Nondestructive tests to evaluate the physical and mechanical properties (sonic, ultrasonic. and other methods).

Session B

Wood Quality: Factors That Affect It, and Improvement Through Genetics and Silviculture

(Joint session with Section II, Forest Genetics)

1. Development of an adequate concept of wood quality for the guidance of geneticists and forest managers.
2. The effect of growth conditions on the structure and properties of wood.
3. Progress towards selection and breeding of trees with superior wood characteristics and method of evaluation.
4. Fast, accurate microtechniques and equipment for the evaluation of wood quality in small samples.
5. The natural variability of wood as it affects selection of test material and structural applications of wood.

Session C

Chemistry and Biochemistry of Wood

1. Chemistry of cellulose and its derivatives.
2. Chemistry of lignin.
3. Biochemistry of natural disintegration of wood.
4. Biochemistry of wood extractives.
5. Chemical conversion products from wood.

Session D

Lumber Manufacture and Wood Processing

1. Choosing the right type of sawmill to fit specific needs.
2. Mechanization and automation of small sawmills.
3. Automation in wood processing industries.
4. Improvements in sawing technology and new methods of cutting wood (sonic methods; thick veneer slicing; other slicing).

Session E

Integrated Utilization, Including Small Sized Timber and Mill Residues

1. Improved utilization efficiency through integrated wood industries.
2. Use of thinnings and forest residues.
3. Use of sawdust and mill residue.
4. Better utilization of low-quality woods through processing research.
5. Use of wood and wood residues in production of fiberboard and particle board.

Session F

Wood Preservation and Protection

1. Penetration of chemicals into wood.
2. New preservatives and treatment method.
3. Status of biology and control of marine borers.
4. Fungus and insect problems in storage and use of wood.
5. Fireproofing of timber.

Session G

Progress in Developing New Pulp Sources

1. Pulping broadleaf trees (general paper).
2. Pulping tropical woods.
3. Newsprint from broadleaf woods.
4. Kraft paper and paperboard from broadleaf woods.
5. Feasibility of small pulp mill operation.

SECTION VII. FOREST AND RANGE WATERSHEDS

Session A

Protection Forests

1. Forest practices in control of avalanches, floods, and soil erosion.
2. Shelterbelts:
   a. Design
   b. Crop yields

Session B

Management for Water Production

1. Riparian vegetation.
2. Controlling forest composition.
3. Effective cutting practices.
4. On municipal watersheds.
5. Management problems ahead.

Session C

Management for Protection of Soil and Water

1. Logging methods in relation to streamflow and erosion.
2. Grazing management practices.
3. Grazing effect on soil stability and forest production.
4. Forest and range watersheds in a Mediterranean climate.
5. Water regulation for increased timber production.

SECTION VIII. FOREST RECREATION AND WILDLIFE

Session A

Management of Forest Lands for Recreation

1. Techniques of managing public use of forested areas.
2. Preserving a pleasing landscape.
3. Recreational values of South American forests.
4. Problems of recreational management of open forests in some countries of Southeast Asia.

Session B

Wildlife Resources of Forest Lands

1. Moral and ethical aspects of hunting and angling for sport.
2. Ecological aspects of game control measures in African wilderness and forested areas.
3. Wildlife management and protection in U. S. forests.
4. Wild game production and harvesting methods in intensively managed forests of Northern Europe.
5. Wild game management in U. S. S. R. forests.

Session C

The Administration and Use of Forested Parks, Wilderness and Natural Reserves

1. The values and uses of wilderness: A world view.
2. The national parks and preserves of Africa: Their significance and problems affecting their future.
3. Natural reserves in densely populated, highly industrialized nations.
4. People and natural reserves.
5. The establishment of parks in Western Pacific nations.

SECTION IX. LOGGING AND FOREST OPEPRATIONS

Session A

Planning and Management of Operations

1. Preparation and use of logging plans.
2. Training and safety of logging and forest workers.
3. Effect of mechanization on forest

labor efficiency.
4. Social progress of forest workers.

Session B

Planning and Management of Operations

1. Significant trends in felling, limbing and log preparation in the woods.
2. Efficient cable operations.
3. Tractor skidding vs. animal skidding in tropical countries.
4. Prospects of debarking and chipping in the woods.
5. Equipment and methods for small trees, plantations and small holdings.

Session C

Log Handling and Primary Transport

1. Logging road location, spacing, and standards.
2. Logging road construction and maintenance.
3. Loading and unloading trucks and rail cars.
4. Land vs. water transport of logs.
5. Truck vs. rail haul of forest products.

SECTION X. TROPICAL FORESTRY

Session A

1. The regeneration and establishment of tropical forests:
   a. By natural regeneration
   b. By planting (including exotics and enrichment)
2. Obstacles to tropical forestry:
   a. Lack of markets and incomplete utilization
   b. Land tenure
   c. High management costs

Session B

1. Intensive vs. extensive management of tropical forests.
2. Shifting agriculture:
   a. Benign and malignant aspects
   b. Case histories

Soil Moisture Distribution Between Trees in A Thinned Loblolly Pine Plantation

Comparisons of the soil moisture regime under different cover types have been made by various investigators, but little attention has been given to the distribution pattern of moisture under trees in forest stands. To obtain distribution information, soil moisture was observed in a 16-year-old loblolly pine plantation near Union, S. C.

Soil moisture samples were collected at the end of the first and second growing seasons following thinning when soil moisture had been largely depleted and when antecedent rainfall amounted to less than 0.7 inch for the preceding 4 weeks. Soil samples of the surface 4 feet were taken at 2-foot intervals along a line between trees. Six sets of two trees each were selected for study. Sampling began about three inches from one tree and ended at the base of a second tree approximately 20 feet away. Percent moisture by weight was converted into inches of available water and average soil moisture content was plotted over distance from the tree (Fig. 1).

Soil moisture was distributed fairly evenly between trees at the beginning of the growing seasons, as shown by the data collected in May. Water loss after the thinning was due to water intake by roots of the nearest trees and by evaporation. At the end of the 1957 and 1958 growing seasons the soil moisture content was highest midway between trees and lowest adjacent to the trees. In 1957 this difference in moisture levels was significant at the .05 probability level and in 1958 at the .01 level. In the surface 4 feet of a nearby unthinned plantation, the moisture content of soil remained relatively constant between trees during both years.

The difference in moisture levels between trees and under trees averaged 3 inches in 1957 and 2 inches in 1958, which may indicate that the effect of the thinning is decreasing. This could be caused by extension of roots into areas not occupied by living roots and/or increased evaporation between trees.

These observations illustrate a limitation of the use of random sampling methods for determining soil moisture. Random samples are valid for stands in which the amount of moisture does not differ significantly from place to place. However, during some seasons the amount of moisture under thinned stands may vary significantly at different distances from the tree and random sampling will give a biased moisture estimate. In such

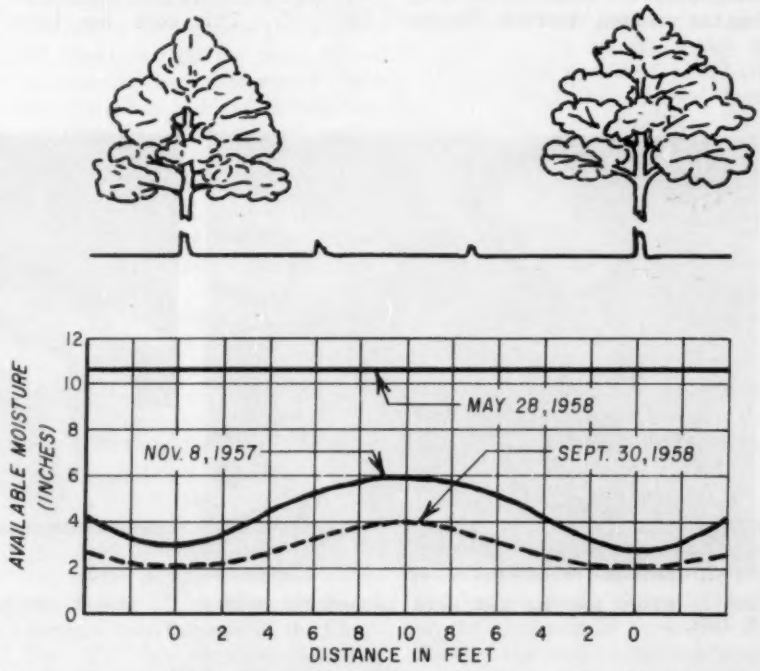

FIG. 1.—A comparison of the spring and fall distribution of soil moisture beneath a loblolly pine plantation thinned in March 1957.

stands other sampling techniques, such as stratified sampling, can be employed to obtain unbiased moisture estimates and should be considered for use.

JAMES E. DOUGLASS
Southeastern Forest Experiment Station, Forest Service, U. S. Department of Agriculture, Asheville, N. C.

A Prostrate Mutant of Black Locust

A prostrate specimen of black locust (*Robinia pseudoacacia* L.) was recently discovered in Ohio and propagated from root cuttings in 1958 at the Ohio Agricultural Experiment Station. The tree is quite procumbent, as shown in Figure 1. Ramets obtained from the tree exhibit the same form characteristics as the tree from which they were taken (Fig. 2).

The tree was discovered by Robert Mingus of the Ohio Division of Reclamation in a young strip-mine spoil bank plantation of black locust on land of the Ohio Power Company near East Fultonham, Ohio. No flowering or fruiting has yet been observed. The tree was planted as a seedling and was about five years old at the time the photograph was taken.

Several form variations of the species are listed in the literature (*2, 4*) but the writer has been unable to find any published report of a prostrate mutant. No other distinguishing characteristics have yet been noted.

The prostrate form has aroused interest because of its possibilities for use on strip-mined areas. Black locust is the primary species planted on these areas and is used in mixture with other more valuable hardwoods because of its high survival capacity and its leguminous characteristic of nitrogen fixation. However, it soon overtops the other species and becomes an inhibiting factor. A low-growing form of locust would eliminate this problem if it could be satisfactorily propagated. It might also be useful on other areas where a low-growing form of plant is desirable.

Since the mutant is a cultivated variety (cultivar), of lower rank than species, it can be considered to fall within the province of the new International Code of Nomenclature for Cultivated Plants, as formulated in 1953 and modified in 1958 (*1*). This code has been adopted by botanists, agriculturists, and foresters, and is in full agreement with the International Code of Botanical Nomenclature (*3*).

Although it was previously the practice to give Latin epithets to plants in cultivation, the new code for cultivars requires that the name must be in a modern language rather than Latin. For purposes of identification therefore, the mutant will be designated as the "Ohio Prostrate" black locust, or in formal terms, *Robinia pseudoacacia* 'Ohio Prostrate.'

Literature Cited

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2. KELSEY, HARLAN P., and WILLIAM A. DAYTON. 1942. Standardized plant names. Second ed. Amer. Joint Comm. on Hort. Nomencl. McFarland Co., Harrisburg, Pa. xvi + 675 pp.
3. LANJOUW, J. ET AL. 1956. International code of botanical nomenclature. International Bureau for Plant Taxonomy and Nomenclature, Utrecht. 338 pp.
4. REHDER, ALFRED. 1949. Manual of cultivated trees and shrubs hardy in North America. Second ed. The Macmillan Co., New York. xxx + 996 pp.

H. B. KRIEBEL
Ohio Agricultural Experimental Station, Wooster

FIG. 1.—Mutant prostrate black locust, photographed on May 5, 1958.

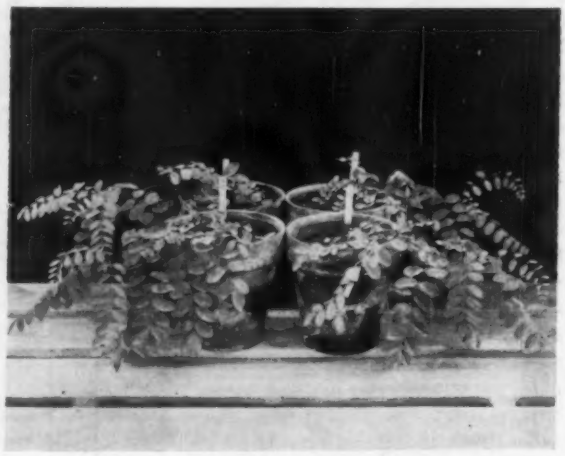

FIG. 2.—Rooted cuttings of prostrate black locust.

Points of View

Replies to Comments on Forestry Education and Licensing

I am in agreement on many points brought forth by Jay H. Hardee's writing in the Points of View column in the October 1959 JOURNAL OF FORESTRY;[1] however, I am compelled to take issue with two of his expressions.

First, relative to his statement, "There is a vacuum between the professional forester and the woods laborer. They hardly understand one another."

I agree that this vacuum does exist, but to justify the expenditures of educational funds in the United States today for the training of subprofessional practical foresters without first increasing the funds available for raising the standards and levels of education for professional foresters would seem to me to be "hitching the cart ahead of the horse." Actually, the vacuum that causes me the most worry is the one that exists today between the corporation forester and the president of the company, the state forester and the governor, the industrial forester and the banker, the head of the forestry school and the president of the university.

These are some of the vacuums that we should recognize and strive to eliminate if we are ever to bring the forestry profession (and the individual professional forester) into its appropriate place as a learned profession. The forester will never become an accepted professional in the eyes of the public (nor the other professions) until he earns the acceptance. This he can do only by raising his educational and professional standards and his value to the community.

Today the forest industries, federal and state governments and educational institutions are crying for professionals with executive, administrative, teaching and research abilities. But let us face the fact that many of the so-called professional foresters being graduated from our unaccredited, and even accredited schools, today are not equipped to bridge the gap (or vacuum) that exists between "practical forestry" on the one hand and "professional forestry" on the other. This is the vacuum that causes me much greater concern than that which exists between the "professional forester" and the "woods laborer."

Second, Mr. Hardee states: "I do not think that licensing is all we want as foresters. This may be necessary to regulate the conduct of those who do not meet ethical standards. But this would likely be in the hands of politicians rather than in the hands of professional foresters."

As chairman of the Alabama State Board of Registration for Foresters, I feel compelled to defend the distinguished membership of the board, every member of which is a graduate of an accredited school and a member of the Society of American Foresters. Each member of the Alabama Board was appointed by the governor from a list of 10 foresters professionally qualified under the law. The list from which the governor made his selection was prepared and presented by a select committee of the Alabama Chapter, Society of American Foresters, through the chairman of the Chapter. The law requires that this procedure be followed in all future appointments to the board.

If licensing and registration in Alabama ever falls into the "hands of politicians," it will have to be "politicians" who are graduates of accredited schools of forestry, members of the Society of American Foresters and who are recommended to the governor by the select committee of the Alabama Chapter, Society of American Foresters, all of which makes it very unlikely that politicians will ever take the Alabama Board away from the professional forester.

I fully agree with Mr. Hardee that "we are concerned with the problem of enhancing the prestige of professional forestry." I would like to be numbered among the hundreds and hundreds of American foresters who have worked through the years to enhance the prestige of our profession. I stand ready to aid Mr. Hardee in every way possible to solve the problems being faced by the profession of forestry today.

R. V. MILES, JR.
Vice president—Forestry,
Gulf States Paper Corp.,
Tuscaloosa, Ala.

Mr. Jay H. Hardee in Points of View in the October issue of the JOURNAL states that "licensing of foresters would likely be in the hands of politicians rather than in the hands of professional foresters." As chairman of the Board of the Registration of Foresters for the State of Georgia I take strong issue with this statement.

The Georgia State Board of Registration for Foresters is in its 9th year and during that time the control has not passed from the hands of the professional foresters. By the very law that created this board such action is impossible. Two nominees for the Board Member-

[1]Hardee, Jay H. Comments on "What kind of forestry schools?" Jour. Forestry 59:761-762. 1959.

ship are selected by the Georgia Chapter of the Society of American Foresters and these two names are presented to the Georgia governor. The governor then selects one of the two recommended by the Chapter for membership on the board for a five-year term. A new member is appointed each year as the staggered terms expire. The licensing law further states that "all members of the board must be members of the Society and have at least ten years of professional forestry experience."

During the nine years of the board's existence only professional foresters have been members of the board. Former members of the Georgia Board of Registration have been Charles E. Evans, former president of the Society; B. E. Allen, present member of the Society Council; Harley Langdale, Jr., active conservationist and forester; and Archie E. Patterson, professor of forest management at the University of Georgia and an active participant in the development of forestry licensing within the Society.

Present members of the board include the dean of the University of Georgia Forestry School, the director of the State Forestry Commission, a consulting forester, a pulpwood company forester, and myself.

There is little reason for the licensing of foresters to be under the control of anyone other than professional foresters. The only way that this could evolve would be for foresters themselves to give away the privilege granted to them by our state legislature.

Under our law and the laws of the two other states which are presently issuing forestry licenses there is no logical reason for control to be lost from professional foresters' hands. We in Georgia have been particularly blessed with a legislature that has granted us not only permissive registration but as of last year granted the board mandatory licensing powers.

To practice forestry in Georgia on other than your own private land, requires a license. It is a misdemeanor in this state to practice without a license and this very act within itself has raised the standards of forestry practice in Georgia by eliminating the use of the term of forester by those not qualified.

The right to license foresters was granted by those selfsame politicians of which Mr. Hardee seems so concerned.

A measure of man's intelligence is how he benefits from history. The history of forestry licensing, while short, has given no indication of the loss of control of licensing power by professional foresters. As chairman of the Georgia State Board of Registration for Foresters, I deeply resent the implication that our board or any other professional board will fall into the hands of unqualified nonprofessional people.

ROBERT D. DIXON
Chairman of the Georgia State Board of Registration for Foresters, Atlanta

Comments on "Are Subsidies Necessary to Stimulate Private Forestry?"[1]

In the September, 1959 Council's Column, W. D. Hagenstein raises the question "Are Subsidies Necessary to Stimulate Private Forestry?" He suggests that certain *public* subsidies are not and that this subject should receive debate at a future meeting.

Mr. Hagenstein objects to one group of public subsidies saying: "Those to landowners for planting, pruning, thinning, protecting or otherwise improving forest assets are of questionable justification."

I think it an excellent idea to consider the question of subsidies in forestry, but the field should not be limited to those suggested by Mr. Hagenstein.

As a professional society we can start right at home. For example, in our dues structure we charge from as little as $3 per year for Students to $15 for Fellows and Members. The cost of the JOURNAL alone is $9 a year. Should the benefits of a professional society be so apparent to all foresters that they will join without the lure of a subsidy? The JOURNAL OF FORESTRY receives a preferential mailing rate. Should we resolve that at the close of business each year the Society send the Postmaster General a check to cover the difference between the actual cost of handling the JOURNAL and the postage paid?

In the field of public subsidies there are a host of other actions by the government which may constitute subsidies. In addition, there are some that are really public tax-supported but privately administered. For example, I am told that in the South alone, private industry gives small landowners, at no cost, some 50,000,000 trees a year plus forestry advice.

If these trees cost $250,000 to produce and the companies in this endeavor are in the 50 percent tax bracket, Federal tax income is thus being reduced by a private subsidy. The stockholders of the companies, too, are subsidizing tree planting on non-company lands. Can this be justified?

The very Tree Farm Program Mr. Hagenstein is associated with may be subsidizing private forestry by performing services for some landowners at less than the cost. If public subsidies are improper then are not private subsidies?

Should forestry assistance and fire protection be furnished with public funds to private landowners at less than cost if these landowners post their lands against reasonable public use? Should subsidies be conditional?

[1] Hagenstein, W. D. Are subsidies necessary to stimulate private forestry? Jour. Forestry 57:643. 1959.

I am sure that there are those who will be willing to argue that some of the things I have listed as subsidies are not at all.

If the Council elects to go into the question of subsidies it may wish to take certain essential steps before opening the subject at an annual meeting. Representatives from each section might be chosen to draw up a list of *possible* subsidy situations with a brief statement of facts on why each is included. The Council might then select study committees to examine each subject area and prepare a pro and con analysis by a given date. These could be published in an issue of the JOURNAL and a year allowed for members to submit additional thoughts. Then the subject of subsidies could be taken up with a real factual background at a Society meeting.

It may well be that all subsidies are not bad. The question then is whether and how they serve to effectively advance the general welfare. A landowner may have a tract of land best suited to growing trees. It may have been so handled in the past that present and future income potential is nil. Yet as a nation 40 years from now, we may need the wood that 40,000,000 such acres can produce. The landowner may not want to or may be unable to restore this land to production. How are we going to get the job done? The same argument can be made for work which stabilizes the soil and protects watersheds.

Perhaps as members of a profession we can make a contribution to the nation's policies and needs by insuring that all subsidies in forestry are capable of being adequately defended as being in the national interest.

On such a basis Mr. Hagenstein's suggestion would have a real appeal. There are many other forest policy subjects susceptible to the same careful identification, study, deliberation and resolution by our profession.

ROBERT E. WOLF
Professional Staff Member, Committee on Interior and Insular Affairs, U. S. Senate

Proposal for Stockpiling Wood Samples for Teaching Purposes

Is there a service which the Society of American Foresters might render to the schools of forestry in this country and perhaps other countries in sponsoring a wood supply pool for the teaching of wood technology?

I presume every forestry school teaching wood identification shares the problem of obtaining the necessary small amounts of lumber of a wide variety of species to cut into hand samples for laboratory use.

Each school uses a relatively small volume of wood each year of a number of species. If larger volumes are obtained, that left in storage loses its odor, color, and similar identifying characteristics over a period of time. I presume we all write many letters to many lumber companies, alumni and other groups or agencies in an effort to get our supply. We impose on these agencies or companies for gifts. Sales, in most instances, can hardly pay for the cost in handling 50 or less board feet.

Perhaps the Society could lend its support to some forestry school, more or less centrally located, to set up a lumber storage area and arrange for the purchase or acquisition by other means of fair stock of 80 to 100 species which could be ordered by institutions in need of particular species. If the institution could prepare the lumber storage area the cost of lumber purchases, transporation, and labor might very well come from the lumber purchases by the various schools.

There is the problem of initial cost in setting up such a program. Perhaps consideration has been given such an idea in the past. It might be interesting to have the reaction of others faced with a similar problem if this be a project the Society might sponsor.

L. P. PLUMLEY
Director, New York State Ranger School, Wanakena, N. Y.

Editor's note.—If any school of forestry or forest products research center will volunteer to establish a supply of wood samples as an aid in teaching wood identification, the Society of American Foresters will be glad to notify prospective users of its availability.

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Book Reviews

The Colonel William B. Greeley Lectures in Industrial Forestry: No. 3: The Development of Industrial Forestry in the Northeast

By Clarence S. Herr. 50 pp. Illus. University of Washington, Seattle. 1959. No price indicated.

Clarence Herr, vice president of the Brown Company of Berlin, N. H., draws on his long experience in both public and private forestry in the Northeast in presenting this, the third in a series of lectures. These were made possible by a grant to the College of Forestry at the University of Washington by the Industrial Forestry Association as a memorial to the late Colonel W. B. Greeley. Previous lecturers have covered the development of industrial forestry in the Northwest and the southern pine regions.

Industrial forestry got an early start in the Northeast as forest-based enterprises were a natural part of the early settlements. Maine claims one of the early sawmills, if not the earliest. The cutting of the King's "Broad Arrow" pines for use as masts in the ships of the English Navy provided one of the more colorful chapters in the early history of the forests. The pulp and paper industry also got a very early start in this region. The development of these projects as well as the history of the early land grants, and the speculations in Maine timberlands provide much of the material set forth most interestingly in the first part of these lectures. The wealth of historical material available in this section of the country makes selection most difficult but the author has done a notable job in picking out the highlights of interest to foresters.

The second portion of these lectures describes the current situations in industrial forestry. Among the programs and policies that the modern forest industries are supporting are those which are discussed in some detail. These are found in the descriptions of logging methods, utilization of waste, milling practices, tree farms, cooperative growth studies, and the recreational use of timberlands.

"Pat" Herr was for many years the extension forester for the State of New Hampshire. Consequently he can speak from considerable experience on the problems which the small owner in the Northeast faces in the management of his timberland and of the importance of these ownerships to the industries. This he does in the third portion of his lectures. This same experience also makes it possible for him to describe some of the problems peculiar in the growing of white pine which is so abundant in central New England. Considerable attention is given to this species and its importance to the economy of the region.

For those unfamiliar with industrial forestry in the Northeast, the booklet provides a wealth of material that describes the conditions prevailing in the section. Those familiar with this area will find historical material which will help explain the reasons for the present degree of development of forestry.

E. L. Giddings
Superintendent, Penobscot Development Co., Old Town, Maine

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Accreditation: The Struggle over Standards in Higher Education

By William K. Selden. 138 pp. Harper & Brothers, New York. 1960. $2.50.

During the past two decades no activity of the Society of American Foresters has contributed more to the advancement of forestry and the prestige of the forestry profession than its work in educational accreditation. About ten years ago the Society voluntarily agreed to cooperate with the National Commission on Accrediting, a newly organized association of colleges and universities that sought to establish policies that would be mutually acceptable to the institutions and the various accrediting agencies

Under the aegis of the Commission, a needed measure of conformity and uniformity in accrediting practices has been brought about. Today six regional educational associations and 22 professional societies carry on accrediting practices with the minimum of necessary bother, and with considerable benefit, to the institutions examined.

As secretary of the National Commission on Accrediting, William K. Selden has given friendly and understanding guidance to the Society of American Foresters in its efforts to maintain adequate standards of professional education in forestry. In consequence, his book deserves the careful reading of all foresters concerned with higher education.

Accreditation in education is a development that is wholly indigenous to America. Frequently misunderstood and occasionally condemned, it is nevertheless the best, perhaps the only, criterion of adequacy, at least as regards education for the professions. In all professions it has been the precursor of state licensure. Parenthetically, Dr. Selden notes the relationship between licensing and accreditation, and lists the professions in which licensure requirements give strong support to accrediting.

As is well known, among the first professions to develop accreditation as a means of raising educational standards were medicine and law. Following these were land-

scape architecture, library science, music, nursing, optometry, teacher education, and business education; then a little later, chemistry, dentistry, engineering, forestry, pharmacy, social work, theology, veterinary medicine, and others.

A perceptive reader cannot help but be impressed by the educational statesmanship revealed in this slim volume. Dr. Selden takes the long view. For example: "In modern society," he writes, "higher education can function adequately only with the aid of some organizational method that maintains academic standards. However, for the sake of both education and society, these standards must be established and enforced with enlightenment and imagination."

Scholarly, urbane, and witty, Dr. Selden has compressed into a small, easily readable book a convincing philosophy of higher education, together with an historical account of the development of accreditation. Selden on Accreditation will certainly not be the last word on this fascinating subject, but his is incontestably one of the most trenchant currently in print.

HENRY CLEPPER

❦❦❦

John Muir, Naturalist: A Concise Biography of the Great Naturalist

By John W. Winkley. 141 pp. Published by the Contra Costa County Historical Society of California. Printed by the Parthenon Press, Nashville, Tenn. 1959. $2.50.

In the Alhambra Valley, Calif., a short distance from San Francisco, in a small, private cemetery is the grave of John Muir, famed American naturalist. Resting beneath an eucalyptus tree whose beauty Muir would have admired, the Muir grave has much in common with the old Muir home near Martinez. As the author writes: "The old John Muir house on the hill stands lonely, shabby, ghostly, among its unkempt remnants of his world gathered ornamental trees and shrubs." It is this object of Muirania, the Muir home, which the Contra Costa County Historical Society has been campaigning to have preserved and made a monument to the memory of John Muir. To call attention to their goal, the society has published this book.

The author faced a difficult task in writing a "concise biography" of John Muir. If it can be said that some men possess an essence especially suited to the art of biography, Muir is one of them. He was a prodigious writer of books, articles, and letters; an indefatigable explorer of the West; and a scientist of worldwide stature. A remarkable personality, he was both forceful and dreamily poetic.

Considering the book's purpose and the subject's dimensions, the author has admirably succeeded in creating a concise biography. The major elements of Muir's life are adequately treated for defining him as a personality, naturalist, and conservationist. But there is more of Muir beyond this concise image an interested reader would find worthy, and for it he would need to consult a more lengthy treatment.

The first two chapters record Muir's origins and early boyhood in Dunbar, Scotland, and his youth on a Wisconsin farm. The hardness and frugality of these years evidently prepared him for the hardships he was to endure during wilderness travels later on, and he never felt bitter or resentful of his early life.

Chapter three traces important formative episodes in Muir's life, particularly his botanical studies. Although he was a mechanical genius, his chief interest was the natural world. When an industrial accident almost cost him his eyesight in 1867, he set off on foot to walk 1,000 miles to the Gulf of Mexico to continue his botanical explorations, a trip which finally brought him to the West and California.

Muir's explorations and studies in the mountains of California, other parts of the West, and Alaska, covered in chapters six through nine, represent the most fruitful years of his life. Using Yosemite Valley as a base, Muir explored the Sierra Nevada, studying glacial action, plants, and insects. His first writing dealt with the geology of Yosemite, and it was Muir who first advanced the theory of glacial action forming Yosemite Valley. Subsequently he studied many parts of the West, and through his writings not only brought national attention to the beauty he saw but also gained a worldwide reputation and influence for himself. These years led to Muir's leadership in the establishment of the National Park System and Forest Reservations.

Entitled "John Muir's Service to the World," the last chapter is an excellent characterization of this great man. As the author writes: "John Muir was a humanitarian. . . . His great achievements lay in his leadership in the establishment of National Parks and Forest Reservations. . . . John Muir was a scientific observer of unusual skill and success, not simply in one restricted field, but in many. . . . John Muir's service to the world was not simply in the things he discovered and publicized. He was himself one of the great contributions to humanity's treasure of mind and spirit."

DENNIS E. TEEGUARDEN
School of Forestry
University of California

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Hydrology

By Chester O. Wisler and Ernest F. Brater. 2nd ed. 408 pp. Illus. John Wiley & Sons, Inc., New York. 1959. $9.15.

When Charlie Hursh reviewed the first edition of this college textbook 10 years ago, he took that opportunity to tell JOURNAL readers that hydrology held the solution of many forestry prob-

lems. The first edition, he said, was a good book. This second edition, in some respects, is even better.

Today there is not the pressing need to sell foresters on the close link between forests and water supplies. Watershed management has been dinned into foresters so much for the past 10 years that they have enthusiastically adopted the term as their own, often equating adoption with accomplishment. The authors of this text (both authors are from the Department of Civil Engineering, University of Michigan) also recognize the place of forests in hydrology—though with some uncertainty.

Pursuing the raindrop from fall to flood, the authors begin with the hydrograph, the streamflow record; and after pointing out its essential characteristics they devote 5 of the 12 chapters to the factors that influence it: precipitation, infiltration and soil moisture, ground water, and evaporation and transpiration. Then follows an excellent chapter on runoff from small plots, small watersheds, and large watersheds with a detailed exploration of the unit hydrograph. Examples of calculations in this chapter add much to the text.

Contributing authors are responsible for the next two chapters, both new to this edition. One deals with the hydrology of semiarid regions (not an anamoly). The other is an informative chapter on snow. A chapter on floods describes and evaluates various methods of flood prediction and strongly suggests a procedure based on the unit hydrograph principle—again, with good examples. A final chapter on streamflow records contains a good account of current-metering.

The authors are most at home in their chapters dealing with analysis of streamflow data. They are less certain in discussing soil and vegetation influences. Engineering terms crop up in odd places: the soil zone is described as the overburden penetrated by roots; soil porosity, as the percentage of voids in a given volume of aggregate. Methods of taking "continuous" records of soil moisture are referred to. The "closed-phytometer" is said to be the favorite method of foresters of determining transpiration, and the now little-regarded transpiration ratio is perpetuated. Croft and Monninger's soil-moisture content differences, from their well-known Utah study, are described as streamflow differences; and, curiously, snow measurement with a standard can, but not with a snow-tube, is discussed.

These and a few other questionable statements suggest that engineer-hydrologists are still not altogether familiar with the forestry and soil aspects of this field. In time a text may be written that will delineate forest hydrology and its applications to forest watershed management. Until forester-hydrologists have the knowledge to prepare a text we must seek our hydrology in books such as this, and in so doing, learn.

HOWARD W. LULL
Northeastern Forest Experiment Station, Forest Service, U. S. Department of Agriculture, Upper Darby, Pa.

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Aboriginal Man and White Man as Historical Causes of Fires in the Boreal Forest, with Particular Reference to Alaska

By Harold J. Lutz. 49 pp. Yale University School of Forestry, New Haven, Conn. 1959. $1.

The actions of man, whether aboriginal or modern, make for more interesting reading than the more technical aspects of fire and its causes, and in this publication the author has dealt with a readable subject in an interesting and informative manner.

Professor Lutz has spent many seasons in Alaska studying the effects of fire on the vegetation of the interior. His 1956 bulletin[1] on this subject points out that boreal forests are very susceptible to destruction by fire, that lightning is one of the causes but man is chiefly responsible. The present work on aboriginal man and white man as a cause of fire comes as a result of delving into a mass of reference material (128 are directly cited) in order to determine among other things if man-caused fires dated back only to gold rush days in Alaska, and whether the original inhabitants had too much respect for their hunting grounds to burn them up. Some say the natives were careless with fires or deliberately set the forest afire. Others say they recognized that forest fires damaged their environment, but the weight of evidence, according to the author, points to carelessness with fire.

Aboriginal man used fire in signaling, setting fire to whole trees to indicate a point of rendezvous, direction of travel, or merely to announce his arrival in the country. He used fire for hunting, warfare, and for combatting insect pests. To repair his canoe he would build a fire to melt gum, then go on, leaving the fire to spread. His campfires were often deliberately left to smolder in the hope that they would continue to burn until his return from a hunting trip. Aboriginal man almost never bothered to extinguish any of his fires.

The author concludes that white man was the cause of even more fires in the boreal forest than was aboriginal man. He was just as careless, used fire for the same purposes plus several additional ones, and could light a fire much more handily. He employed fire in clearing land and to promote growth of grass for livestock. Prospectors used fire to expose surface rock. The white man has been known to set the forest afire "just to see it burn."

Each of the uses to which ab-

[1]Lutz, H. J. Ecological effects of forest fires in the interior of Alaska. U. S. Dept. Agric., Tech. Bul. 1133 ii 121 pp. 1956.

original man and white man put fire is described and conclusions are drawn in each case as to their role in causing forest fires. A short chapter discusses early fires of unknown origin in the boreal forests of Alaska in chronological order from 1843 to 1915, mostly as described by early explorers, missionaries, soldiers or other travelers.

The author concludes, in a short summary, that it is probable there were fires in the northern forests ever since there were forests to burn. Destruction has been enormous but the boreal forest has generally shown a remarkable capacity to recover.

This Yale bulletin is a "must" in understanding the fire problems of our largest state.

R. F. TAYLOR
Utah State University, Logan, Utah

Publications of Interest

The Vermont State Board of Forests and Parks at Montpelier has issued a brochure of 66 pages entitled *History of Forestry in Vermont: 1909-1959*, by Perry H. Merrill, which tells of the growth and accomplishments of the Vermont Forest Service during the past 50 years and mentions those who played an active part in the building of a service of which every citizen of the state may be proud.

• • •

The proceedings of the Symposium on Direct Seeding in the South, which was held at Duke University during April 1959, are now available and copies may be obtained from the School of Forestry, Duke University, Durham, N. C., at $3 each.

• • •

The Minnesota Foundation has just issued a brochure to accompany a new 16 mm, color-sound motion picture entitled *Fire on the Land*, directed and photographed by Roy Dale Sanders. This film is technically accurate and authentic, and deals with some of the basic concepts of wildfires—their causes and effects. It places special emphasis on the need for and essential steps of fire prevention in connection with smoking, campfires, children playing with fire, and the householder who "just wants to clean up the place." Information concerning sales and distribution may be obtained from Minnesota Foundation, 305 Wilder Bldg., St. Paul 2, Minn.

Correction

The price of $5 given for the manual *Fire Fighting Methods and Techniques* on page 937 of the December, 1959 issue of the JOURNAL was incorrect. The correct price is $2.50 parcel post, as quoted by the publisher, Northeastern Forest Fire Protection Commission, State Bank of Albany Building, Chatham, N. Y.

A Note of Thanks

Beginning with this issue of the JOURNAL the monthy listing of Current Literature (other than range management) is being supplied by Mrs. Lois P. McAllister, assistant librarian, State University College of Forestry at Syracuse University, Syracuse, N. Y.

Mrs. McAllister succeeds Mrs. Martha Meelig Pindle, librarian of the college. Under her maiden name of Martha Meeling, Mrs. Pindle has been making a notable contribution to forestry literature through the pages of the JOURNAL for 15 years. The profession is in her debt for highly capable services freely given to forestry.

Mrs. Pindle is currently engaged in preparing a cumulative index of the JOURNAL for the years 1951 through 1960.

Coming Events

New England Section

The New England Section will hold its meeting at the Statler-Hilton Hotel, Boston, Mass., March 17 and 18, 1960.

Wisconsin-Michigan Section

The Wisconsin-Michigan Section will hold its winter meeting at the Loraine Hotel, Madison, Wis., March 25-26, 1960.

Intermountain Section

The Intermountain Section will hold its 8th annual meeting March 26 at Twin Falls, Idaho. The theme of the meeting will be "Steep Ground—A Challenge in Natural Resource Management."

Southern California Section

The Southern California Section will hold its meeting in San Bernardino, April 1 and 2, 1960.

Seventh National Watershed Congress

The Seventh National Watershed Congress will be held at the Statler-Hilton Hotel, Washington, D. C., April 18-20, 1960.

Puget Sound Section

The Puget Sound Section will hold its meeting at Port Angeles, Wash., May 13-14, 1960.

Current Literature

Compiled by LOIS MCALLISTER, *Assistant Librarian, State University College of Forestry at Syracuse University*
Range Management Section Compiled by NELLIE G. LARSON, *Library, U. S. Department of Agriculture*

General

Biogeography and Ecology. Ed. by A. Keast, R. L. Crocker and C. S. Christian. 640 pp. Illus. W. Junk, Den Haag, Holland. 1959. Monographiae Biologicae, Vol. VIII. 65 Dutch guilders.

Cambrian Forests. Ed. by H. L. Edlin. 102 pp. Illus. H. M. Stationery Off., London. 1959. Forestry Commission Guide. 5s.

Reindeer Trail; A Long Journey from Lapland to Alaska. By Berta and Elmer Hader. 48 pp. Illus. Macmillan, New York. 1959. $3.25. (Juvenile)

Transplanting Small Trees and Shrubs. By C. S. Chater. 8 pp. Illus. Univ. of Massachusetts, Cooperative Extension Service, Amherst. 1959. Pub. No. 344.

Forest Management

Area Measurement by Weight, A Useful Technique in Forest Inventory. By F. M. Buckingham. 9 pp. University of Toronto, Faculty of Forestry. 1959. Tech. Report No. 2.

Composite Aerial Volume Table for Southern Arkansas. By Gene Avery and David Myhre. 9 pp. Tables. Southern Forest Expt. Sta., New Orleans, La. 1959. Occasional Paper No. 172.

Eighteen Years of Selection Timber Management on the Crossett Experimental Forest. By R. R. Reynolds. 68 pp. Illus. U. S. Dept. of Agric., Washington 25, D. C. 1959. Tech. Bul. No. 1206. 30 cents (Govt. Print. Off.)

Forest Development Opportunities in North Central Mississippi. By H. S. Sternitzke. 40 pp. Illus. Southern Forest Expt. Sta., New Orleans, La. 1959. Occasional Paper No. 173.

Tests of Some Instruments for Measuring Tree Height. By W. G. Warren. 18 pp. Illus. New Zealand Forest Service, Forest Research Institute, Wellington. 1958. Forestry Research Note No. 12.

Logging and Milling

Amount and Grades of Lumber from Black Hills Ponderosa Pine Logs. By E. F. Landt and R. O. Woodfin, Jr. 18 pp. Charts, tables. Rocky Mountain Forest and Range Expt. Sta., Fort Collins, Colo. 1959. Station Paper No. 42.

Finger Jointing. By M. W. Page. 6 pp. Illus. Australia Commonwealth Scient. and Indus. Research Org., Melbourne. 1959. Div. of Forest Prod. Reprint No. 395.

Skidding Entire Cedar Trees to a Landing for Pole Making as a Means of Reducing the Fire Hazard in Logging Slash. By D. S. Olson and Dale Arnold. 7 pp. Illus. Univ. of Idaho Forest, Wildlife and Range Expt. Sta., Moscow. 1959. Research Note No. 16.

Thinner Circular Saws. By D. S. Jones. 8 pp. Illus. Australia Commonwealth Scient. and Indus. Research Org., Melbourne. 1959. Div. of Forest Prod. Reprint No. 396.

Veneer Cutting and Drying Properties: Tanoak. 12 pp. U. S. Forest Prod. Lab., Madison, Wis. 1959. Report No. 1766-15.

Protection

Inflammabilité et Pouvoir Thermique de la Matière Organique de Certains Types Forestiers. By Louis-Philippe Amiot. 24 pp. Illus. Laval Univ. Forest Research Foundation, Quebec. 1959. Contribution No. 3.

Prescribed Burn Fireclimate Survey 2-57. By C. M. Countryman and M. J. Schroeder. 18 pp. Illus. Pacific Southwest Forest and Range Expt. Sta., Berkeley, Calif. 1959. Tech. Paper No. 31.

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Range Management

Cattle Walkways; an Aid to Coastal Marsh Range Conservation. By R. E. Williams. 8 pp. U. S. Dept. of Agric., Washington 25, D. C. 1959. Leaflet No. 459.

The Role of Ecotypic Variation in the Distribution of the Central Grassland of North America. By C. McMillan. Ecol. Monog. v. 29, pp. 285-308. Oct. 1959. Duke University Press, Durham, N. C. $2.

Season of Burning Affects Follow-up Chemical Control of Sprouting Chamise. By R. F. Buttery, J. R. Bentley, and T. R. Plumb, Jr. 11 pp. Pacific Southwest Forest and Range Expt. Sta., Berkeley, Calif. 1959. Res. Note No. 154.

Sweet Sorghum Growing in Southern California. By C. Price and I. E. Stokes. 11 pp. U. S. Agric. Res. Serv., Washington 25, D. C. 1959. ARS 34-10.

Silviculture

Food Reserves in Post Oak Stumps and Roots. By W. C. Elder and J. E. Webster. 11 pp. Oklahoma Agric. Expt. Sta., Stillwater. 1959. Tech. Bul. No. 80.

Forecast of Yield in Relation to Thinning Regimes in Douglas Fir. By G. C. Warrack. 56 pp. Illus. British Columbia Forest Serv., Victoria. 1959. Tech. Pub. No. 51. 50 cents.

Ground Vegetation as an Index of Site Quality in White Spruce Plantations. By J. D. Gagnon and J. D. MacArthur. 12 pp. Tables. Canada Dept. of Northern Affairs and Nat'l. Res., Forestry Branch, Ottawa. 1959. For. Research Div. Tech. Note No. 70.

Intermediate Cuttings in Red and White Pine Plantations. By W. M. Stiell. 27 pp. Tables. Canada Dept. of Northern Affairs and Nat'l. Res., Forestry Branch, Ottawa. 1959. For. Research Div. Tech. Note No. 81.

Seeding and Planting Red and White Pine. By W. M. Stiell. 19 pp. Map, tables. Canada Dept. of Northern Affairs and Nat'l. Res., Forestry Branch, Ottawa. 1959. For. Research Div. Tech. Note No. 80.

Site Index Comparisons for Several Tree Species in the Virginia—Carolina Piedmont. By D. F. Olson, Jr. and Lino Della-Bianca. 9 pp. Illus. Southeastern Forest Expt. Sta., Asheville, N. C. 1959. Station Paper No. 104.

Soils

La Dynamique du Sol Forestier en Climat Atlantique. By Philippe Duchaufour. 72 pp. Diagrams. Laval Univ. Forest Research Foundation, Quebec. 1959.

Soil Moisture Depletion under Several Piedmont Cover Types. By L. J. Metz and J. E. Douglass. 23 pp. Illus. U. S. Dept. of Agric., Washington 25, D. C. 1959. Tech. Bul. No. 1207. 15 cents (Govt. Print. Off.)

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Seasoning and Preservative Treatment of Hickory Crossties. By M. A. Taras and Monie Hudson. 24 pp. Illus. Hickory Task Force and Southeastern Forest Expt. Sta., Asheville, N. C. 1959. Hickory Task Force Report No. 8.

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Lumber and Timber Utilization Survey Report, Virginia, 1959. By R. S. Burruss, Jr. and B. T. Dempsey. 12 pp. Tables. Lumber Manufacturers Assn. of Virginia, Inc., Richmond. 1959.

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The Rate of Sorption of Water Vapour by Wood. By G. N. Christensen and K. E. Kelsey. 44 pp. Australia Commonwealth Scient. and Indus. Research Org., Melbourne. 1959. Div. of Forest Prod. Reprint No. 391.

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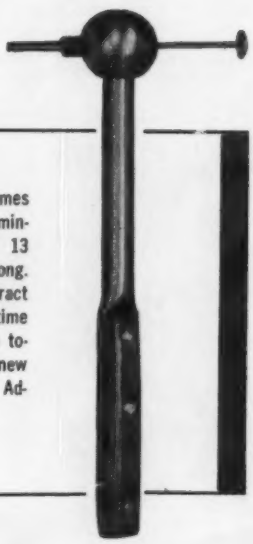

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The Forestry Profession and Land Use Pressures

There is not enough land in America to accommodate all uses and satisfy all pressures. These are well recognized facts that have been pointed out frequently in recent years. These facts bring about certain problems in applied land management which are being felt nationwide in increasing complexity and intensity.

Foresters, in particular, are feeling the pressures generated by limitations of land. This is due to an increasing number of assignments or dedications of forest land being requested to satisfy particular needs. As a result, foresters are under mounting pressures to decide between present and proposed management objectives.

Some of the strongest pressures are felt from recreation seekers. Traditionally many Americans turn to the out-of-doors and especially to the forest to find their recreation. They hunt, fish, camp, picnic, or just plain enjoy walking or driving in the woods.

Those who hunt may feel that forest management practices should include wildlife habitat improvement. The fishermen may insist that forest utilization maintain or improve fish habitat. The campers and picnickers have their own set of standards for a forest environment. The wilderness enthusiast has his particular requirements for satisfaction.

Aside from recreation, the water user may insist on special land use measures to insure a continuous or improved water supply. Or any given wood user may want pulpwood, sawlogs, peeler logs, or other specialty products in quantities which are not anticipated under presently planned cutting cycles or rotations.

These are examples only. Add your own illustrations to make the list more complete and realistic.

Steadily, however, the pressures for adjusted management objectives are getting stronger. Moreover, these pressures are bound to increase as the population and its collective demands increase. Those especially concerned with a given product or service do not feel that their interests can be satisfied without special provisions. They want assurance guaranteed by dedication of land. This circumstance prevails on publicly and privately owned land alike.

Sometimes the problems that these pressures bring about can be avoided by astute observation and planning. Other times they can be properly softened or blunted by being alert to the situation with actions characterized by vision and energy.

In any event, if any forester thinks this pressure on the land is not going to reach him, he has his head in the sand. Moreover, he is in for trouble if he does not awaken to what is happening. In this respect, the forester should be constantly weighing his management objectives. Are they correct in the light of current developments? Are adjustments being made fast enough to keep ahead of changing pressures? Is the future being anticipated with realism?

These questions are particularly applicable to the forester who has direct responsibility for administering land. They are equally applicable, also, to other segments of the profession. The educator needs to assess whether or not his instruction is conceived and pointed correctly. The research worker needs to evaluate the timeliness and adequacy of his program in terms of pressures on the land. The utilization expert should appraise the source of the product with which he is concerned and what effect land use pressures will have on its supply.

In short, these pressures touch the entire profession one way or another. A widespread realization of this fact is essential if we are going to keep pace professionally with the public and its needs and demands.

Shifts of management objectives as called for to meet the pressures of changing times may take many forms. Generally, however, the most success will be achieved in working out a sound pattern of management within the framework of the multiple use concept. In some instances, application of multiple use is not going to be the best answer. In these cases the forester is fully justified in adopting limited use but in the main he must carry the burden of proof if he elects to depart from multiple use. Obviously, it is imperative that any system of management be constantly analyzed and adjusted as needed.

Actually there is nothing new about pressures for dedication of forest land to specific uses. It is a fact, however, that these pressures are being intensified greatly. They have now reached a point where an individual forester's success or failure, and similarly the status of the profession, will be measured to a great degree on how well these pressures are understood and met.

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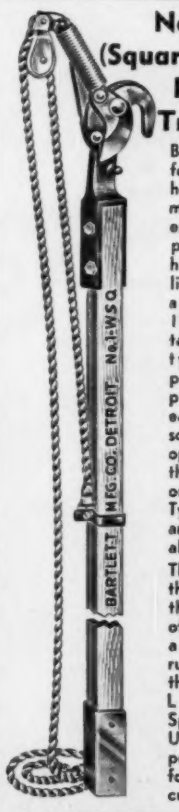

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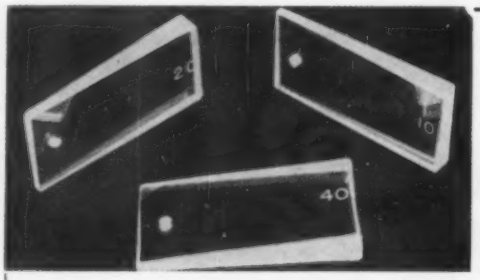

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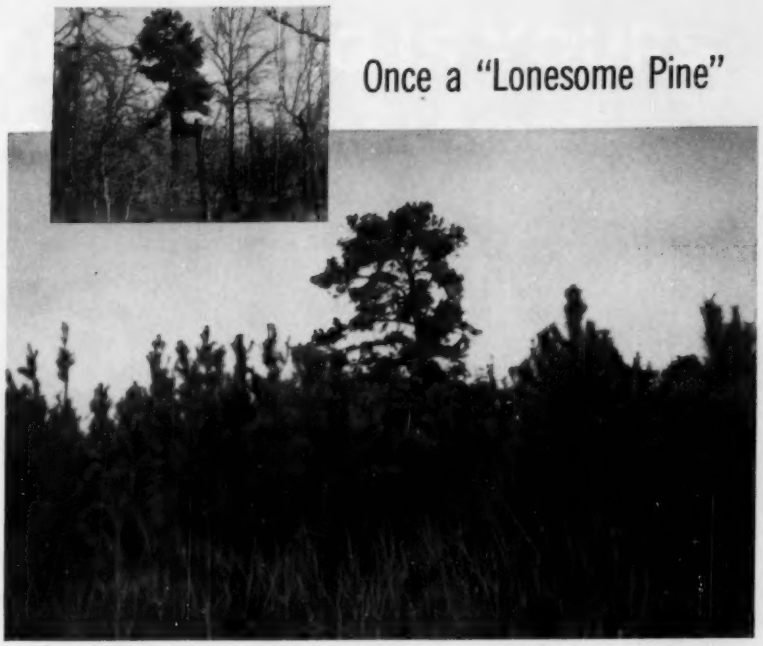

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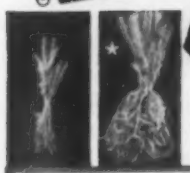

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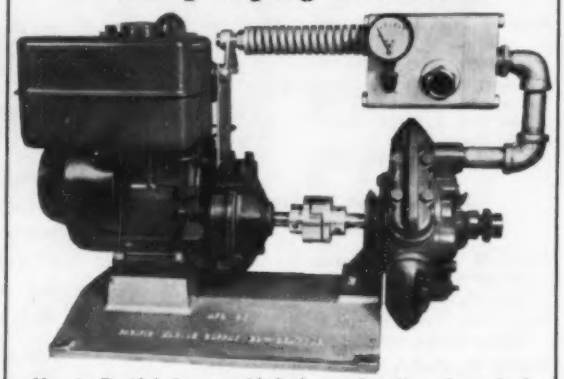

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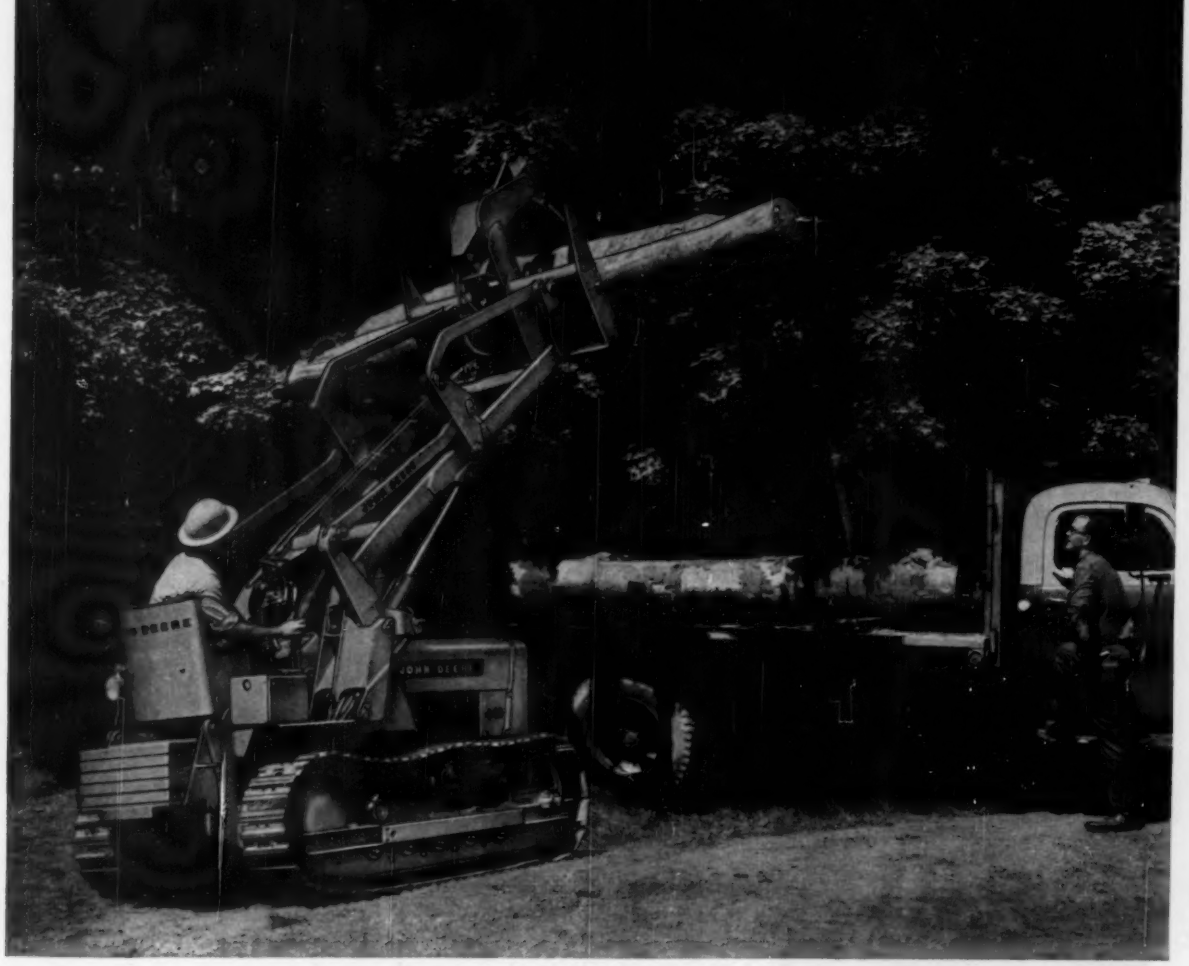

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University of California, School of Forestry, Berkeley 4, Calif.

Colorado State University, College of Forestry and Range Management, Fort Collins, Colo.

Duke University, School of Forestry, Durham, N. C.

University of Florida, School of Forestry, Gainesville, Fla.

University of Georgia, School of Forestry, Athens, Ga.

University of Idaho, College of Forestry, Moscow, Idaho.

Iowa State University, Department of Forestry, Ames, Iowa.

Louisiana Polytechnic Institute, Department of Forestry, Ruston, La.

Louisiana State University, School of Forestry, Baton Rouge 3, La.

University of Maine, School of Forestry, Orono, Maine.

University of Massachusetts, Department of Forestry and Wildlife Management, Amherst, Mass.

Michigan College of Mining and Technology, Department of Forestry, Houghton, Mich.

Michigan State University, Department of Forestry, East Lansing, Mich.

University of Michigan, School of Natural Resources, Ann Arbor, Mich.

University of Minnesota, School of Forestry, St. Paul 1, Minn.

University of Missouri, School of Forestry, Columbia, Mo.

Montana State University, School of Forestry, Missoula, Mont.

University of New Hampshire, Department of Forestry, Durham, N. H.

State University of New York, College of Forestry, Syracuse 10, N. Y.

North Carolina State College, School of Forestry, Raleigh, N. C.

Oregon State College, School of Forestry, Corvallis, Ore.

Pennsylvania State University, School of Forestry, University Park, Pa.

Purdue University, Department of Forestry and Conservation, Lafayette, Ind.

Utah State University, College of Forest, Range and Wildlife Management, Logan, Utah.

University of Washington, College of Forestry, Seattle 5, Wash.

West Virginia University, Division of Forestry, Morgantown, W. Va.

Yale University, School of Forestry, New Haven 11, Conn.

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(1959)

San Francisco, Calif. Meeting

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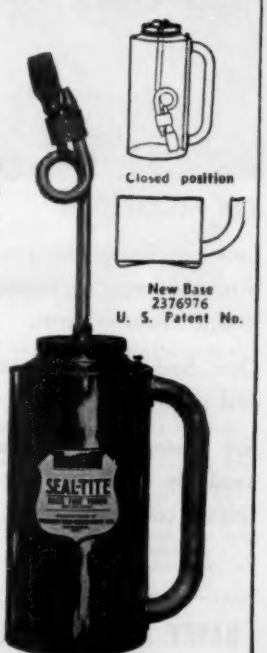

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North Central School of Agriculture, Grand Rapids, Minn.

North Dakota Agricultural College, Department of Horticulture and Forestry, Fargo, N. Dak.

North Dakota School of Forestry, Bottineau, N. Dak.

Northern Michigan College, Department of Conservation and Forestry, Marquette, Mich.

Northwestern State College, Agriculture Department, Natchitoches, La.

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Paul Smith's College, Forestry Department, Paul Smiths, N. Y.

Pasadena City College, Pasadena 4, Calif.

University of Rhode Island, Forestry Department, Kingston, R. I.

Rutgers University, Department of Forestry, New Brunswick, N. J.

University of Tennessee, Department of Horticulture and Forestry, Knoxville 16, Tenn.

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Duffield Named Forest Science Editor

President Charles A. Connaughton has appointed Dr. John W. Duffield to the position of editor of *Forest Science* to succeed Dr. Stephen H. Spurr, School of Natural Resources, University of Michigan. Dr. Spurr, who has served as editor during the first five years of the quarterly journal, resigned the editorship in order to accept a Fulbright assignment in New Zealand.

Dr. Duffield is technical director, Industrial Forestry Association, Nisqually, Wash. For the past several years he has served as an associate editor of the JOURNAL OF FORESTRY.

Dr. Harlan H. Hatcher, President
University of Michigan
Ann Arbor, Michigan

Dear Dr. Hatcher:

Dr. Stephen H. Spurr, of the faculty of your School of Natural Resources, has tendered his resignation as Editor of the quarterly journal, FOREST SCIENCE, in view of his pending Fulbright assignment in New Zealand. This has been accepted by the Council of the Society of American Foresters, sponsoring organization for the publication, with grateful recognition of Dr. Spurr's notable contributions, both in initiating the journal project and in directing the development of the magazine to a position of recognized standing among the world's scientific publications.

The Council has asked me to convey to you the appreciation of the Society of American Foresters for the privilege of having Dr. Spurr's outstanding services during this critical five-year period in the development of our new publication. We are understandably proud of the results of his varied labors on behalf of the Society.

Sincerely yours,

|s| GEORGE A. GARRATT
President

December 29, 1959

Albert W. Slipp (1906-1959)

Albert W. Slipp died in his home December 10, 1959. Professor Slipp had been a member of the staff of the College of Forestry, University of Idaho for the past 20 years.

He was born August 10, 1906, in North Sydney, Nova Scotia, Canada. He was graduated from the University of New Brunswick in 1930 with a B.S. in Forestry. Following course work at Harvard and Emory Universities he went to Idaho as a research associate and in 1939 was granted a Master of Forestry degree. Subsequently he took on full time research and later teaching responsibilities. Professor Slipp was a recognized authority on white pine blister rust having spent the past 22 years in research on this disease. He was also interested in fungus ecology and was co-author of the only work on the ecology of the Boletes of the Inland Empire. He was a member of numerous scientific organizations including Xi Sigma Pi, Sigma Xi, American Phytopathological Society, and the Society of American Foresters.

Floyd I. Dewald (1898-1960)

Floyd I. Dewald, Trenton, N. J., died early January 20 following injuries received when his car was struck by a train. He had been a member of the New Jersey Department of Conservation and Economic Development since 1927, and presently served as chief of the parks section in the Division of Planning and Development.

Born in Auburn, Pa., in 1898, Mr. Dewald served in World War I and later attended Pennsylvania State University where he received a B.S. degree in forestry. He was stationed in Montana as a U. S. forest ranger for six years before employment in New Jersey. His first assignment was at Stokes State Forest. During the 1930's he was chiefly responsible for the coordination of Civilian Conservation Corps projects in the state forests and parks.

He also had served as chairman of the Allegheny Section of the Society of American Foresters.

Mr. Dewald was a dedicated conservationist and during his 37 years of state service he made notable achievements in the expansion of state forest and public lands.

Charles Weldon Kline (1898-1959)

Charles Weldon Kline, timber manager for the W. H. Daugherty Lumber Co., died of a heart attack December 22, 1959, in Medford, Ore.

Mr. Kline was born August 4, 1898, at Birdsboro, Pa. He attended Pennsylvania State College and graduated from the University of Washington with a B.S. degree in Logging Engineering in 1922. He was a registered licensed logging engineer in the State of Oregon. (*Cont. on page* 246)

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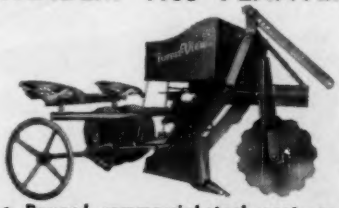

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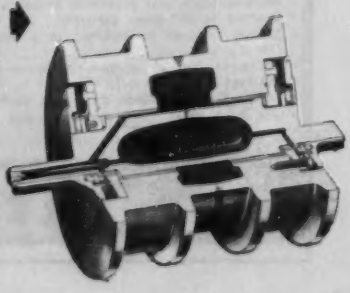

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During his long career as a forester, Mr. Kline held many positions with the timber industry and the U. S. Forest Service. He managed his own logging company for ten years; served on the lumber division of the War Production Board in Washington, D. C. in 1946; managed the timber department for Harbor Plywood Co., Riddle, Ore. for four years; and after a brief term as timber manager for M and M Woodworking Co., Albany, Ore., he accepted a similar position with the Southern Oregon Sugar Pine Co., at Medford. This company was acquired by the W. H. Daugherty Lumber Co. in 1953 and Mr. Kline continued as timber manager for the new company until his death.

He had been a member of the Society of American Foresters since 1925.

Membership Applications and Advancements

Proposals for admission, advancement, and reinstatement received in the Society office during the month of January are listed below.

Action on the eligibility of those proposed for membership as listed below will be taken by the Council as of March 1960.

Communications from the voting members regarding the membership eligibility of these persons should be received in the Society office prior to that date.

Allegheny Section

Student Grade

PENNSYLVANIA STATE UNIVERSITY

Fosnocht, W. A.

WEST VIRGINIA UNIVERSITY

Strickland, J. R.

Member Grade

Koch, C. B., Asst. Prof., W. Va. University, Morgantown, W. Va. (Junior 50R56).

Rodihan, W. F., Forester, W. M. Ritter Lbr. Co., Wyoming, W. Va. (Junior 1953).

Appalachian Section

Student Grade

NORTH CAROLINA STATE COLLEGE

Johnston, J. T. Mahaney, A. R.
Kendall, W. A. Snyder, D. H.

Junior Grade

Buckhalt, J. E., Procurement Forester, Owens Illinois Glass Co., Big Island, Va. (Reinstatement).

Member Grade

Adams, P. W., Land Bank Appraiser, Federal Land Bank, Columbia, S. C. (Junior 1953).

Gentry, B. W., Consulting Forester, Lumberton, N. C. (Junior 1951).

Hasell, T. M., Dist. Supv., International Paper Co., Wilmington, N. C. (Junior 1953).

Langley, W. R., Assoc. Land Bank Appraiser, Federal Land Bank, Columbia, S. C. (Junior 1953).

Lockhart, R. E., Dist. Forest Ranger, USFS, Covington, Va. (Junior 1953).

Rhines, S. W., Sub Dist. Forester, Caroline and King George Counties, Va. (Junior 1953).

Steele, J. L., Forester, International Paper Co., Winnsboro, S. C., Univ. Ga., BSF, 1956 (Junior 1956).

Swanson, S. R., County Forester, N. C. Dept. of Cons., Newton, N. C. N. C. State College, BSF, 1940 (Junior 1956).

Swensen, J. H., General Foreman, Steel Heddle Mfg. Co., Greenville, S. C. (Junior 1953).

Wright, L. O., Cons. Forester, Union Bag-Camp Paper Corp., Walterboro, S. C. (Junior 1953).

Central States Section

Student Grade

PURDUE UNIVERSITY

Coppess, B. O.

Central Rocky Mountain Section

Student Grade

COLORADO STATE UNIVERSITY

Walters, M. D.

Columbia River Section

Student Grade

OREGON STATE COLLEGE

Armstrong, W. S.

Junior Grade

Abrenietis, V. V., Forester, Bur. of Indian Affairs, Warm Springs, Ore. (Affiliate 1957).

Fruits, G. W., Asst. Dist. Warden, Oregon State Board of Forestry, John Day, Ore. (Reinstatement).

Osborne, W. B., Self Employed, Portland, Ore. Yale Univ., MF, 1949.

Tandy, D. J., Dist. Ranger, USFS, Idleyld Park, Ore., Univ. Wash., BSF, 1950.

Wagoner, A. L., Chief Logging Eng., Roseburg Lbr. Co., Roseburg, Ore. Univ. Wash., BSF, 1949.

Member Grade

Binford, B., 5241 Alva Ave., Klamath Falls, Ore. (Junior 1953).

Brandis, J. S., Mgr. Georgia Pacific, Corvallis, Ore. (Junior 1953).

Damerell, W. L., Tbr. Maintenance Supv., State Tax Comm., Salem, Ore. (Junior 1953).

Dykeman, K. K., Tbr. Mgmt. Asst., USFS, Klamath Falls, Ore. (Junior 1953).

Elisar, R., Asst. Nurseryman, Wind River Nursery, Carson, Wash. (Junior 1953).

Gardner, A. D., USFS, Oakridge, Ore. (Junior 1953).

Horn, R. W., Mgr., Mendsha Plywood, North Bend, Ore. Ore. State College, BSF, 1932 (Junior 1956).

Jackson, C. B., Forester, USFS, Gold Beach, Ore. W. Va. Univ., BSF, 1954 (Junior 1955).

Knowles, G. E., Ellingson Lbr. Co., Klamath Falls, Ore. (Junior 1953).

Lee, R. F., Forester, Tbr. Mgmt., Salem, Ore. (Junior 1953).

Maul, T. W., Exec. Asst., Oregon State

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Board of Forestry, Salem, Ore. (Junior 1953).
Naish, R. A., Asst. Ranger, Bear Valley Dist., John Day, Ore. (Junior 1953).
Pryor, R. L., Sr. Forester, Oregon State Board of Forestry, Astoria, Ore. Purdue Univ., BSF, 1956 (Junior 1956).
Resler, R. A., Tbr. Mgmt. Officer, USFS, Eugene, Ore. (Junior 1953).
Sabol, E. M., USFS, Oakridge, Ore. (Junior 1953).
Schoonover, N. B., Forester, Hemlock Ranger Station, Carson, Wash. (Junior 1953).
Welsh, D., Asst. Dist. Administrator, Forest Mgmt., North Bonneville, Wash. (Junior 1952).

Affiliate Grade

Corn, D. G., Forester, USFS, Maupin, Ore.
Zevely, J. K., Field Asst., Cascade Lbr. Co., Yakima, Wash.

Gulf States Section

Junior Grade

Bryan, R. W., Institution Counselor, Central La. State Hospital, Pineville, La. (Reinstatement).

Member Grade

Hansbrough, T., Asst. Prof., La. State Univ., Baton Rouge, La. La. State Univ., BSF, 1949, MF, 1957 (Junior 1956).
Lamar, A. J., Dist. Forester, Southland Paper Mills, Inc., Trinity, Texas. Univ. Mo., BSF, 1956 (Junior 1956).
Waller, D. B., Area Forester, Champion Paper & Fibre Co., Conroe, Texas, Stephen Austin College, BSF, 1948 (Af1951J1956).

Inland Empire Section

Student Grade

UNIVERSITY OF IDAHO

Brock, R. J. Lund, R. H.
Hamner, B. H. Runberg, D. E.
Underwood, J. F.

Member Grade

Deward, C. J., Forester, Potlatch Forests, Inc., Lewiston, Idaho. Utah State Univ., BSF, 1951 (Junior 1956).
Fields, J. F., Forester, Bur. of Land Mgmt., Coeur d'Alene, Idaho (Junior 1953).
Kale, W. S., Inventory Crew Leader, Potlatch Forests, Inc., Lewiston, Idaho (Junior 1953).
Marr, W. R., Research Forester, Potlatch Forests, Inc., Lewiston, Idaho (Junior 1953).
Radtke, D. L., Forester, Clearwater Natl. Forest, Orofino, Idaho (Junior 1953).

Associate Grade

Maloy, O. C., Research Forester, Potlatch Forests, Inc., Lewiston, Idaho.

Kentucky-Tennessee Section

Junior Grade

Morton, J. K., Service Forester, Tenn. Div. of Forestry, Livingston, Tenn., N. C. State College, BSF, 1959.
Prather, C. F., Service Forester, Ky. Div. of Forestry, Hazard, Ky. (Affiliate 1958).

Member Grade

Dale, M. E., Research Forester, USFS, Beren, Ky. (Junior 1953).
Noble, M., Forester, Robinson Forest, Quicksand, Ky. (Junior 1953).

New England Section

Student Grade

UNIVERSITY OF MASSACHUSETTS

Franz, G. J.

Junior Grade

Kimball, T. R., Service Forester, Maine Forest Service, Cornish, Maine. Univ. Maine, BSF, 1955.
Smith, R. S., Service Forester, Maine Forest Service, Skowhegan, Maine (Reinstatement).

Member Grade

Bennett, D. R., Logging Supv., Brown Co., Wilson's Mills, Maine (Junior 1953).
Chase, E. E., Logging Supv., Great Northern Paper Co., Winterport, Maine (Junior 1951).
Clifford, R. E., Logging Eng., Great Northern Paper Co., Bangor, Maine (Junior 38R54).
Dodge, A. G., Student, Harvard Forest, Petersham, Mass. (Junior 1953).
Godson, L. W., Forester, Scott Paper Co., Greenville, Maine (Junior 48R53).
Ladd, A. B., Forester, Oxford Paper Co., Dixfield, Maine (Junior 1951).
Lane, S. P., Forester, Standard Packaging Corp., Enfield, Maine (Junior 38R56).
Marty, R. J., Forester, Northeastern Forest Expt. Station, New Haven, Conn. (Junior 1953).
Potter, R. W., Lbr. Sales, Center Lovell, Maine (Junior 1953).
Turner, F. J., Consulting Forester, Marlboro, Vt. (Reinstatement).
Van Husen, C. M., Dist. Forester, Scott Paper Co., Jackman Station, Maine. N. Y. State College, BSF, 1955 (Junior 1955).

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Wing, M. R., Asst. Woodland Mgr., International Paper Co., Chesholm, Maine (Junior 1951).

New York Section

Member Grade

Bergmann, T. S., Watershed Supv., Ky. Div. of Forestry, Frankfort, Ky. (Junior 1953).
Collins, R. A., Forester, W. Va. Pulp & Paper Co., Suffolk County, N. Y. (Junior 1953).
Stickney, R. A., Forester, N. Y. State Cons. Dept., Jamestown, N. Y. (Junior 50R55).

Affiliate Grade

Gray, S. K., Forester, N. Y. State Cons. Dept., Lowville, N. Y.

Northern California Section

Student Grade

UNIVERSITY OF CALIFORNIA

McLaughlin, R. F.

Ozark Section

Student Grade

Wheeler, E. Y., Asst. Prof., Oklahoma State Univ., Stillwater, Okla. State Univ. N. Y., BSF, 1956.

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UNIVERSITY OF MISSOURI

Begeman, G. F.

Affiliate Grade

Rodgers, D. A., Forester, USDA, Mountain View, Ark.
Whisenhunt, J. D., Lt. U. S. Marine Corps, Camp Pendleton, Calif.

Puget Sound Section

Student Grade

UNIVERSITY OF WASHINGTON

Coffelt, A. E. White, E. E.

Junior Grade

Bowman, N. B., Asst. Forester, Weyerhaeuser Co., Monroe, Wash. (Reinstatement).

Sterling, R. T., Forester, Aloha Lbr. Corp., Aloha, Wash. (Affiliate 1952).

Member Grade

Flemer, T. A., Photogrammetrist, Wash. Dept. Natl. Resources, Olympia, Wash. (Junior 1953).

Groman, W. A., Forester, Wash. Dept. Natl. Resources, Raymond, Wash. (Junior 1953).

Hoyer, G. E., Inventory Forester, Wash. Dept. Natl. Resources, Olympia, Wash. (Junior 1953).

Novy, R. L., Staff Asst., USFS, Randle, Wash. (Junior 1953).

Orr, T. J., Inventory Forester, Weyerhaeuser Co., Aberdeen, Wash. (Junior 1953).

Pike, C. C., Logging Eng., Weyerhaeuser Co., Aberdeen, Wash. (Junior 50R54).

Reukema, D. L., Research Forester, USFS, Olympia, Wash. (Junior 1953).

Schmidt, M., Logging Supt., Simpson Logging Co., Shelton, Wash. (Junior 1953).

Tveit, O. A., Asst. Branch Forester, Weyerhaeuser Co., Centralia, Wash. (Junior 1953).

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Affiliate Grade

Cope, R. D., Field Forester, St. Regis Paper Co., Orting, Wash.

Malcom, B. A., Forester, St. Regis Paper Co., Tacoma, Wash.

Southeastern Section

Student Grade

UNIVERSITY OF FLORIDA

Kromer, L. P.

UNIVERSITY OF GEORGIA

Collins, A. B. Gibbons, B. W.
Ketchie, N. L.

Junior Grade

Clark, J. T., Self Employed, Quincy, Fla. (Affiliate 1956).

Folsom, N. E., Dist. Supv., Buckeye Cellulose Corp., Foley, Fla. (Reinstatement).

Van Haverbeke, D. F., Research Forester, USFS, Macon, Ga. Colo. State Univ., MS, 1958.

Member Grade

Burtz, O. C., State Dist. Forester, Ga. Forestry Comm., Gainesville, Ga. Univ. Ga., BSF, 1949 (Junior 1954).

Entzminger, P. R., Mgr. Tbr. Dept., Container Corp. of America, Fernandina Beach, Fla. Univ. Fla., BSF, 1948 (Junior 1954).

McElhannon, J. E., Asst. Dist. Forester, Ga. Forestry Comm., Gainesville, Ga. Univ. Ga., BSF, 1942 (Junior 1955).

Affiliate Grade

Whiddon, W., Chief Forester, Weaver Loughridge Lbr. Co., Boyd, Fla.

Southwestern Section

Junior Grade

Correy, R. M., Camp Clerk, Southwest Lbr. Mills, Inc., Flagstaff, Ariz. Colo. State College, BSF, 1956.

Upper Mississippi Valley Section

Student Grade

UNIVERSITY OF MINNESOTA

Dahlen, W. A. Puetz, C. D.
Hecht, G. W. Sober, T.

Junior Grade

Franz, M. H., Asst. Dist. Forester, Minn. & Ontario Paper Co., Big Falls, Minn. (Affiliate 1956).

Washington Section

Junior Grade

Dzulynsky, L. P., Eng., Johnson & Johnson Engineers & Arch., Chicago, Ill. Purdue Univ., MSF, 1956.

Wisconsin-Michigan Section

Student Grade

MICHIGAN COLLEGE OF MINING AND TECHNOLOGY

Guerard, J. A. Kabat, L. R.

Member Grade

Carlson, C. W., Forester, USFS, Milwaukee, Wis. (Reinstatement).

Clayton, R. L., USFS, Rec. Mgmt., Escanaba, Mich. (Junior 35R58).

Farmer, R. E., Research Asst., Univ. of Mich., Ann Arbor, Mich. Univ. Mich., BSF, 1953, MF, 1958 (Junior 1956).

Heikkenen, H. J., Research Forester, Lower Peninsula Research Center, Lansing, Mich. (Junior 1953).

Henley, J. W., Technologist, Forest Products Lab., Madison, Wis. Colo. State Univ., BSF, 1955, MS, 1958 (Junior 1955).

Kunesh, R. H., Grad. Student, Univ. of Mich., Ann Arbor, Mich. (Junior 1953).

Medvick, C., Forester, Nevin Hatchery, Madison, Wis. W. Va., Univ., BSF, 1956, Purdue Univ., MSF, 1958 (Junior 1956).

Olson, D. D., Asst. Dist. Forester, Mich. Dept. of Cons., Fife Lake, Mich. (Junior 1953).

Phillips, E. C., Asst. Dist. Forester, Mich. Dept. of Cons., Indian River, Mich. (Junior 1953).

Schepers, B. E., Div. Line Clearing Foreman, Consumers Power Co., Muskegon, Mich. (Junior 1953).

Schoener, R. J., 221 Main St., Eagle River, Wis. (Junior 1953).

Sharpe, G. W., Asst. Prof. of Forestry, Univ. of Mich., Ann Arbor, Mich. (Junior 51R55).

Skilling, D. D., USFS, Wausaw, Wis. (Junior 1953).

Sliker, A., Asst. Prof., Mich. State Univ., East Lansing, Mich. (Junior 1953).

Smith, P. C., Spring Lake Road, Rhinelander, Wis. (Junior 1953).

Youngs, R. L., 4713 Ames St., Madison, Wis. (Junior 1953).

Zahner, R., Assoc. Prof., Univ. of Mich., Ann Arbor, Mich. (Junior 1953).

No Section

Corresponding Grade

Altintas, A., National Forest Supv., Natl. Forest Service. Ankara, Turkey.

Du, L. V., Student, Ministry of Agric., Vietnam.

Faizi, B. M., Director of Forestry, Helmand Valley Authority, Afghanistan.

Koh, C. C., Jr. Specialist, Taiwan Forest Research Institute, Taiwan, China.

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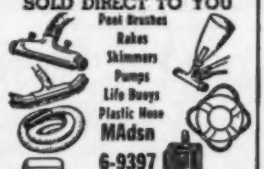

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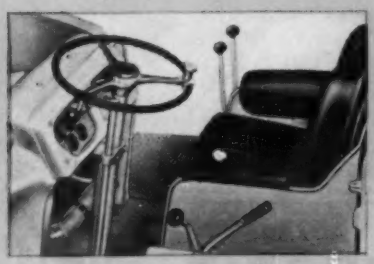

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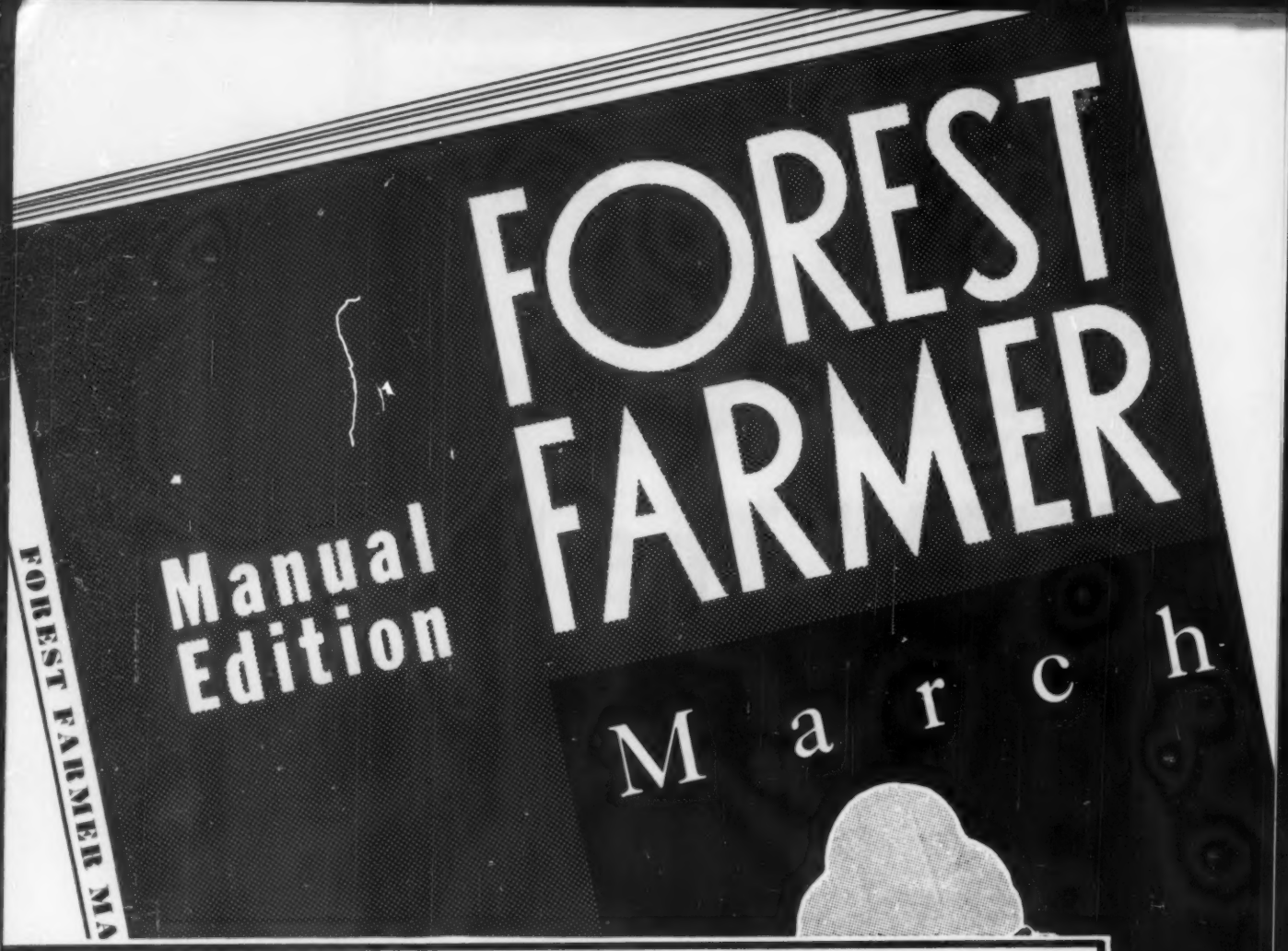

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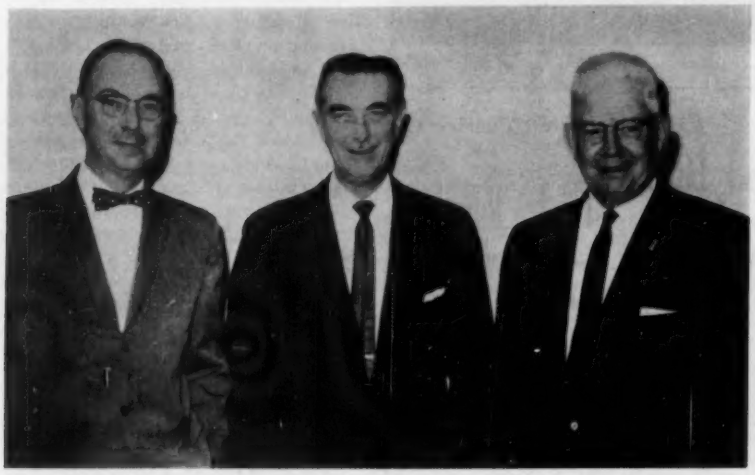

Karl A. Swenning, re-elected president of the Southern Pulpwood Conservation Association; H. J. Malsberger, general manager; and J. E. McCaffrey, elected vice president of the Association for 1960, (*left* to *right*) photographed at the annual meeting, Atlanta, Ga., January 12-13, 1960.

Four Foresters Win American Motors Awards

Recipients of the annual series of 20 American Motors Conservation awards recently announced by George Romney, president of the automobile company, include four foresters.

Among 10 professional workers in resource conservation selected were: Travis M. Tyrrell, Portland, Ore., Bureau of Land Management Area forestry officer; Earl D. Sandvig, recently from the U. S. Forest Service, and now living in Honolulu; and Ezra R. Miller, Los Angeles County Fire Department.

Among 10 individuals honored for non-professional services was Don P. Johnson, (unsalaried) president of the American Forestry Association, at one time a member of the U. S. Forest Service.

Conference on Pest Control and Wildlife Relationships

A conference on pest control and wildlife relationships was held on January 15 in the National Academy of Sciences, Washington, D. C.

Sponsored by the Division of Biology and Agriculture of the National Research Council, the conference was attended by some 60 invited representatives of wildlife, medical, forestry, agricultural, chemical, and scientific agencies. Henry Clepper represented the Society of American Foresters. Other foresters present were Tom Gill, Ivan H. Sims, James A. Beal, Warren V. Benedict, Lloyd F. Swift, and James C. McClellan.

The consensus of the group was that greatly increased research efforts are needed as a preliminary to the widespread application of insecticides, herbicides, and other pesticides in the control of agricultural and forest pests.

It is expected that a special committee of the National Research Council will be established to provide necessary liaison and leadership in this field.

Insurance Company to Publicize Forestry

A number of Society members will be interested to learn that the New York Life Insurance Company plans to devote one of its 1960 series of public service advertisements to the profession of forestry. Mr. F. L. Cooper, director of advertising for the company, has written the JOURNAL that although no definite rate has yet been set for appearance, Mr. Frederick K. Weyerhaeuser has agreed to serve the

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Butcher Edits New National Wildlands News

Devereaux Butcher, former executive director of the National Parks Association and writer, is editing a new publication, *National Wildlands News*. The first issue, dated December, 1959, says it is "an independent newspaper dedicated to the preservation of national parks, monuments, and wildlife refuges as nature sanctuaries." He will be aided in the project by Mrs. Butcher, associate editor Mary Hazell Harris, and Western editor J. F. Carithers. The *News* will be published monthly, except in August, from 2607 Connecticut Avenue, N. W., Washington 8, D. C. It sells for 10c per copy or $1 per year.

Private & Industrial

SPCA Holds Annual Meeting

Karl A. Swenning, director of timberlands, Scott Paper Company, was re-elected president of the Southern Pulpwood Conservation Association; and J. E. McCaffrey, vice president of International Paper Company, was elected vice president of the Association at the annual meeting in Atlanta, January 12-13, according to H. J. Malsberger, general manager.

Approximately 500 representatives of the pulp and paper industry along with top state and federal government leaders heard an outstanding group of speakers interpret the conference theme, "Complete Use of the Forest for All."

Speakers included Karl Bendetsen, former Under Secretary of the Army, now executive vice president, Operations Group of The Champion Paper and Fibre Co., Hamilton, Ohio; C. B. Stauffacher, who was executive assistant director of the U. S. Bureau of the Budget, and is now executive vice president of the Robert Gair Paper Products Group of Continental Can Co., Inc., New York, N. Y.; W. A. Binns, training director of Union Bag-Camp Paper Corp., Savannah, Ga.; Philip A. Briegleb, director of the Southern Forest Experiment Station, New Orleans, La.; and Bernard L. Orell, vice president of Weyerhaeuser Co., Tacoma, Wash. and a member of President Eisenhower's Outdoor Recreation Resources Review Committee.

President Swenning opened the two-

day meeting of the Association with the president's address, followed by reports of general manager, H. J. Malsberger, and assistant general manager, John C. Witherspoon.

APA Selects New Forester

William C. Hammerle has been appointed forester for the American Pulpwood Association effective January 4, 1960. He has served for several years as executive secretary of The Southeastern Pine Marketing Institute.

Mr. Hammerle began his career in forestry with the U. S. Forest Service. He served as district forester in the North Carolina Department of Conservation and Development-Division of Forestry; as district forester, assistant state forester, and later state forester with the South Carolina State Commission of Forestry; and director, Division of Forestry of the Georgia Department of Natural Resources. Hammerle, at one time, was in charge of the forestry department of the Southern Pine Association. Before becoming executive secretary of the SPMI, he was with the Forest Farmers Association as managing editor and advertising manager of the *Forest Farmer*.

In this new position Mr. Hammerle will be responsible to W. S. Bromley, executive secretary of the Association, for the APA Forest Management and Legislative Programs and will assist with the Technical Program. The preparation and editing of APA's monthly mailing consisting of the *News Letter, Forest Notes,* and *Legislative Bulletin* will also be his responsibility.

Mr. Hammerle is a native of New York and a graduate of the New York State College of Forestry at Syracuse University.

Public

A. Ray Shirley New Director of Georgia Forestry Commission

H. Guyton DeLoach, director of the Georgia Forestry Commission, Macon, has resigned and has been succeeded by Arthur Roy Shirley of Valdosta, Ga. Until his recent appointment, Mr. Shirley had been secretary of the American Turpentine Farmers Association Cooperative.

Both are forestry graduates of the University of Georgia; Mr. Shirley in 1936, Mr. DeLoach in 1939.

Starting as a ranger, Mr. DeLoach had been with the Georgia Forestry Commission since 1941.

Mr. Shirley's career has included employment with the U. S. Forest Service, with the Georgia Agricultural Extension Service, and in recent years with the Turpentine Farmers Association. During World War II he was a captain in the Corps of Engineers.

Southwestern Supervisor Changes Announced

The Southwestern Region of the U. S. Forest Service has announced several changes in forest supervisor positions, effective in February.

Two New Mexico National Forest supervisors were transferred to new positions. Everett Doman, supervisor of the Lincoln National Forest, Alamogordo, was named assistant regional forester in charge of Range and Wildlife Management for the California Region of the Forest Service, headquarters in San Francisco. Replacing him as supervisor on the Lincoln is Russell Rea, previously supervisor of the Gila National Forest, Silver City.

The new supervisor of the Gila National Forest is Richard C. Johnson. He moved from supervisor of the Prescott National Forest, Arizona.

New supervisor of the Prescott National Forest, Prescott, Ariz., is Ralph W. Crawford, previously supervisor of the Coconino National Forest, Flagstaff, Ariz. New supervisor on the Coconino National Forest in turn is Jay E. Cravens, former ranger of the Long Valley District. Coconino, and more recently timber management staffman in the Forest Service regional office, Albuquerque, N. Mex.

BLM Forester Promoted in Alaska

The Fairbanks, Alaska, office of the Bureau of Land Management has appointed Fred H. Waldhaus, formerly a forester in the Forestry and Range office, as assistant fire control officer, replacing James W. Scott, who has

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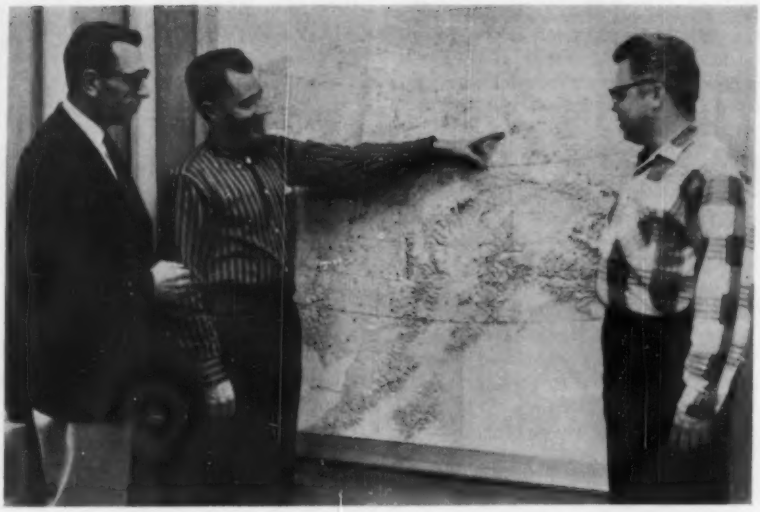

ADVANCE PLANNING: Preparations for the 1960 fire season in Alaska's Interior is done well in advance by the Fairbanks office of the Bureau of Land Management. Fred H. Waldhaus, *right*, was recently appointed assistant fire control officer for the Fairbanks land district. His job will be to supervise protection of more than three-quarters of Alaska's public land area from fire destruction. Fire control problems are discussed with Waldhaus by Richard L. Quintus, Fairbanks operations supervisor, *left*, and Fred W. Varney, fire control officer, *center*. Waldhaus replaces James W. Scott, promoted to fire control staff officer in Anchorage district.

been promoted to fire control staff officer in the Bureau's Anchorage Land District.

Waldhaus becomes principal assistant to Fred W. Varney, Fairbanks fire control officer, and will be in direct charge of the Bureau's forest fire fighters in the Fairbanks district. Employing several hundred fire fighters each summer, the BLM attempts to prevent accidental fires, as well as keep the number of acres of public lands burned over each fire season to a minimum.

Last season, 275 known forest and brush fires burned over 582,000 acres of the 178 million acres of public land requiring protection from the Fairbanks headquarters. The fire fighters use the latest in fire control methods in their battle to keep damage of public lands within the new State of Alaska to a minimum. Last fire season, high speed fire detection and patrol planes were in the air immediately following lightning storm reports or forecasts by the U. S. Weather Bureau, sixteen trained smokejumpers made 164 individual jumps on a total of 34 fires, fire fighting crews received food and supplies using planned parachute-cargo drops, and 157,000 gallons of chemical fire retardant was spread on 32 fires, using specialized charter aircraft.

Anderson New Supervisor of Bitterroot Forest

Harold E. Anderson of Sandpoint, Idaho, was promoted to supervisor of the Bitterroot National Forest in southwestern Montana, effective January 24, according to Chas. L. Tebbe, regional forester.

Anderson replaces Thurman Trosper who was promoted from supervisor of the Bitterroot to the Division of Planning in the Washington, D. C. office of the Forest Service, Tebbe said.

Anderson had served on the Kaniksu National Forest since March 1957 as assistant supervisor and as staff officer in charge of fire control and blister rust. He worked for the Forest Service in Alaska for 11 years before joining the Kaniksu staff.

Anderson graduated from the University of Washington with a degree in forestry in 1941. He did graduate work at Yale University in 1950-1951. He served in the Navy from 1942 to 1946.

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San Juan Forest Supervisor Named

Robert E. Milodragovich, staff officer on the Shoshone National Forest, with headquarters at Cody, Wyo., has been promoted and transferred to supervisor of the San Juan National Forest, Durango, Colo. Milodragovich will fill the vacancy resulting from supervisor Virgil Carrell's promotion to the chief forester's office in Washington, D. C. The appointment was effective January 24.

Mr. Milodragovich received his B.S. degree in forestry from Montana State University in 1939. Prior to his Shoshone assignment, he served as staff officer on the Bighorn National Forest at Sheridan, Wyo. Previously he was assigned as district ranger on the Lewis and Clark, Beaverhead, and Dearlodge National Forests in Montana. From December, 1941, to March, 1946, he served in the armed forces.

Named to Station Staff Post

Herbert H. Muntz has been named staff specialist in forest management at the Southern Forest Experiment Station in New Orleans. The appointment, announced by Station Director Philip A. Briegleb, became effective January 24.

At the time of this appointment, Muntz was in charge of the U. S. Forest Service's research center at Birmingham. Previously, he conducted research in pine planting, seeding, and thinning at Alexandria, La., and in the regeneration and management of bottomland hardwoods at Stoneville, Miss.

After receiving a degree in forestry from Pennsylvania State College, Muntz began work for the U. S. Forest Service in 1934, first in Louisiana and then in Mississippi. At the Alexandria forest research center from 1946 to 1951 he undertook studies that marked the beginning of that center's ultimately successful experimentation with the direct seeding of pine. Upon his promotion to the center in Birmingham, he supervised studies in the management of upland pines and hardwoods.

R. S. Rummell to Washington Post

Robert S. Rummell, in charge of the Fort Myers branch of the Lake City, Fla., Research Center, has been promoted and transferred to the Washington, D. C., headquarters of the U. S. Forest Service. His new position is on the staff of the Division of Range Management, National Forest Resource Management.

Research forester O. Gordon Langdon will be acting officer in charge at Fort Myers.

For the past six years, Rummell has been in charge of forest range research work for the Southeastern Station's Lake City Research Center, which is being done mainly on the 1600-acre Caloosa Experimental Range, about 25 miles east of Fort Myers, in cooperation with the Babcock-Florida Company, which gave the Forest Service the use of the area, furnish the cattle used in the experimental work, and provide for their care.

Rummell began work for the Forest Service in 1944 at Portland, Ore. He holds a Master's degree from Iowa State College and is a member of the SAF and the Ecological Society of America. At present he is secretary and vice-president-elect of the Southern Section of the American Society of Range Management. He is also a member of Gamma Sigma Delta, honorary agricultural society.

Schools

International Forest Tree Growth Conference

A conference on Forest Tree Growth which will be of international scope is to be held at the University of Arizona, Tucson, Ariz., on April 11-13, 1960.

Sponsored by the Tree-Ring Society; the Laboratory of Tree-Ring Research, University of Arizona; Department of Watershed Management, University of Arizona; and the Division of Forestry, Arizona State College, the conference will include noted scientists from the United States, Canada, and Europe. General chairman of the conference is Dr. Terah L. Smiley, director, Geochronology Laboratories, University of Arizona, Tucson, assisted by Dr. Frits W. Went, director, Missouri Botanical Garden, St. Louis, and Dr. Charles O. Minor, director, Division of Forestry at Arizona State College, Flagstaff.

One-half day sessions will be devoted to each of six major fields of study regarding tree growth. Subjects and moderators are: Tree Physiology, Dr. T. T. Kozlowski; Genetics, Dr. Harry A. Fowells; Soils, Dr. Robert Zahner; Climate, Dr. A. L. McComb; Dendrochronology, Dr. George C. Allen; Mensuration, Dr .George M. Furnival. Outstanding foreign speakers will include such men as Elias Melin of Sweden, Donald A. Fraser of Canada, Bruno Huber from Germany, Olaf Langlet of Sweden, and T. F. Wareing from Wales.

All six sessions of the conference will be open to all interested persons. No registration fee is involved.

Additional information concerning the conference, assistance with housing reservations, or details of the final program may be obtained by writing the Tree-Ring Laboratory, University of Arizona, Tucson, Ariz.

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Index to Advertisers

	Page
Adirondack Forestry, Inc.	253
Amchem Products, Inc.	235
Banzhaf, George & Co.	253
Bartlett Mfg. Co.	233
Belanger & Bourget	252
Caterpillar Tractor Co.	249
Coile, T. S., Inc.	254
Crank, Porcius F. Jr.	253
Cranston, Keith	252
Cruise-Master Prisms	246
Deere & Co.	237
Eastman, Wm. A. Jr.	254
Fechheimer Bros. Co.	251
Forest Farmers Assn.	250
Forest Seeds of California	251
ForestView Evergreen Nursery	243
Forestry Suppliers, Inc.	247
Greenacres, Inc.	255
Guthrie, John G.	253
Hall, Albert G.	255
Hall, Jack M.	253
Hammon, Jensen & Wallen	252
Haynes Mfg. Co.	247
Homelite Corporation	4th Cover
Hooker, Gion B.	255
Intermountain Timber Service	254
International Harvester Co.	3rd Cover, 244, 245
Keene Forestry Assn.	246
Knapp, Ed. Co.	254
Lemieux, Frank J.	254
Lind, A. L. Co.	251
Lowther, Harry A. Co.	242
McCulloch Corporation	216, 217
McGraw-Hill Book Co.	240
Meadows, Ben Co.	234
Mora Chemical Co.	232
Motorola	231
Musser Forests, Inc.	236
National Agricultural Supply Co.	236
Nelson Co.	242, 246
Pacific Marine Supply Co.	236
Pacific Weather Service	248
Paint Creek Nurseries	248
Panama Pump Co.	238
Pine Grove Nursery	251
Pioneer Saws Division	178
Pomeroy & McGowin	254
Potts, S. F.	239
Prentiss & Carlisle	255
Price, Wm. H.	253
Rich, C. H. Forest Fire Tool Co.	251
Rootspred Tree Planter	243
Sandvik Steel, Inc.	232
Schultz, C. D. & Co., Inc.	253
Schweigert, Thos. F.	255
Sebrell, J. B. Co.	248
Sewall, James W. Co.	252
Shannon, R. B. & Assoc.	252
Silva, Inc.	246
Smith, D. B. & Co.	2nd Cover
Southern Seed Co.	233
Steigerwaldt, Edward F.	254
Stock, John W.	254
Suncrest Evergreen Nursery	246
Tree Farm Management Service	253
Utility Tool & Body Co.	248
Western Fire Equipment Co.	241
Western Maine Forest Nursery Co.	251
Western Timber Services	254
Winslow, Paul T.	253

West Virginia University Acquires School Forest

In May, 1959 the Division of Forestry, West Virginia University, acquired a 7,500-acre teaching and research forest. This tract, known as the "West Virginia University Forest," was obtained through the cooperation of the Conservation Commission of West Virginia on a 99-year lease. Much of this area is within one-half-hour travel time of the University campus, and is thus ideally suited for field laboratory use.

Located on Chestnut Ridge, the westernmost ridge of the Allegheny Mountains, the predominantly hardwood forests are typical in composition and condition to those found throughout much of West Virginia and adjacent Pennsylvania. An active research program in forest management and wildlife management has already been initiated.

The forest headquarters includes a permanent residence and maintenance buildings. From here a professionally trained forester, a member of the staff of the Division of Forestry, will direct and correlate forest activities.

White Selected as Assistant Director of Forestry School

Wallace E. White, professor of wood technology at the Pennsylvania State University, has been named assistant director of the School of Forestry. Peter W. Fletcher, director of the school, explained that Mr. White will continue to teach and will assist with student counseling, scheduling, course and curriculum matters, student placement and in other duties pertaining to resident education in the School of Forestry.

A native of Boston, Mass., Mr. White received his B.S. and M.S. degrees from the University of Vermont. His Ph.D. degree was conferred by Yale University.

Prior to his initial appointment to the Penn State faculty in 1929, he served as assistant botanist at the Vermont Agricultural Experiment Station and as instructor in botany at the Mont Alto campus. He was appointed professor of wood utilization in 1938 and has been professor of wood technology since 1943.

Mr. White is a member of the Society of American Foresters; Phi Beta Kappa; Xi Sigma Pi; Tau Phi Delta; Alpha Zeta; Society of Sigma Xi; Phi Eta Sigma; Phi Epsilon Phi; and the American Association of University Professors.

Frank Appointed Visiting Professor of Watershed Management

Bernard Frank, formerly assistant chief, Division of Watershed Management Research, U. S. Forest Service, has been appointed visiting professor of watershed management for the spring quarter 1960 at Colorado State University. Since January 1959, Mr. Frank has served as a watershed research consultant in India for the United Nations Food and Agriculture Organization.

On his assignment at Colorado State University, Mr. Frank will teach a course in applied watershed management to seniors and graduate students in forestry, range management and watershed management.

Forestry Employment

S.A.F. members are privileged to insert one 60-word advertisement in this column without charge. Forest industries desiring to employ foresters may insert advertisements at the rate of $4 per column inch. Copy must be received by the end of this month for an advertisement to appear in the issue after next.

Obviously the Society cannot assume responsibility beyond making it possible for prospective employee and employer to enter into negotiations.

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Box G, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, Canadian, age 36, married. Education: B.Sc.(F.), Univ. New Brunswick; M.F., Yale; Teaching Fellow, Syracuse. Experience: 3 years, federal government; 8 years forest economics (5—provincial government, 3—U.N.), particularly resource and industry analysis, harvesting and processing forest products, marketing and trade. Interested: forest economics, sales development, promotion and administration. Desire to return to North America.
Box H, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, B.S., 1951 Univ. of Minnesota. 8½ years forest management experience in northern Minnesota managing 60,000 to 120,000 acres. Handled sales, supervision of permits and scaling. Drew up management plans. Experienced in pho typing and cruising. Did field work and office work for IBM, continuous forest inventory. Supervised annual machine and hand planting programs. Prefer work in Mid-West or West.
Box I, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, B.S., 1956, N. Y. State College of Forestry. Age 25, single, draft status 4A. Experience: 1½ years with U. S. Forest Service. Work included all phases of timber management; cruising; scaling; sale layout; appraisals; surveying; road location; reforestation. Desire Northeast location.
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